INSTRUCTIONS FOR ADDING REVISION 9 TO THE MIDLAND PLANT ENVIRONMENTAL REPORT

This Revision 9 to the Environmental Report (ER) of the Midland Plant consists of pages that are to be inserted into your copy of the ER.

Vertical bars in the margin indicate the location of the revisions in text and tables. Pages without bars are either unchanged pages furnished for continuity or contain minor spelling or editorial corrections which do not change the text content. The pages to be removed and inserted are as follows:

REMOVE	INSERT
Volume 1	
After Tab, LOEP-1 thru LOEP-11	After Tab, Letter and LOEP-1 thru LOEP-11
2.4-9/2.4-10	2.4-9/2.4-10
Volume 2	
2.6-1/2.6-2	2.6-1/2.6-2
Tbl 3.3-1 (1 of 2)/Tbl 3.3-1 (2 of 2)	Tbl 3.3-1 (1 of 2)/Tbl 3.3-1 (2 of 2)
3.4-1 thru 3.4-6	3.4-1 thru 3.4-6
3.4-7b thru 3.4-12	3.4-7b thru 3.4-11
3.4R-1	3.4R-1
3.6-6a/3.6-6b	3.6-6a/3.6-6b
Tbl 3.6-4/Tbl 3.6-5	Tbl 3.6-4/Tbl 3.6-5
3.6R-1	3.6R-1
3.9-3/3.9-4	3.9-3/3.9-4
4.2-1/4.2-2	4.2-1/4.2-2
5-i/5-ii	5-i/5-ii
5.1-5/5.1-6	5.1-5/5.1-6
5.1-7 thru 5.1-10	5.1-7 thru 5.1-10
5.1R-3	5.1R-3
5.1BR-1	5.1BR-1
Tbl 5.2-13 thru Tbl 5.2-16	Tbl 5.2-13 thru Tbl 5.2-16
5.2R-1/5.2R-2	5.2R-1/5.2R-2
Tbl 5.3-1	Tbl 5.3-1
Volume 3	
6.2A-i thru 6.2A-iv	6.2A-i thru 6.2A-iv
6.2A-3-1/6.2A-3-2	6.2A-3-1/6.2A-3-2
Tbl 6.2A-3-1/Tbl 6.2A-3-2	Tbl 6.2A-3-1/Tbl 6.2A-3-2
Tbl 6.2A-3-9/Tbl 6.2A-3-10	Tbl 6.2A-3-9/Tbl 6.2A-3-10

288 318

REMOVE	INSERT
Tbl 12.1-1 (1 of 13) thru Tbl 12.1-1 (13 of 13)	Tbl 12.1-1 (1 of 13) thru Tbl 12.1-1 (13 of 13)
13.3-1/13.3-1a	13.3-1/13.3-1a
13.5-1/13.5-2	13.5-1/13.5-2
Q&R-i thru Q&R-iii	Q&Ri thru Q&R-iii
AEC 2-1	AEC 2-1 thru AEC 2-2
AEC 10-1	AEC 10-1 thru AEC 10-2
AEC 12-1	AEC 12-1
HYD 5-1	HYD 5-1
HYD 6-1	HYD 6-1
PEC 1-1	PEC 1-1
PEC 4-1	PEC 4-1
PEC 6-1	PEC 6-1

319

288 318

LIST OF EFFECTIVE PAGES

	CP Co Transmittal Letter	NRC Receipt
Tendered ER	02/28/78	03/01/78
Docket	04/12/78	04/14/78
Revision 1 - April 1978	05/08/78	05/12/78
Revision 2 - June 1978	06/29/78	07/05/78
Revision 3 - November 1978	11/10/78	11/16/78
Revision 4 - December 1978	12/07/78	12/12/78
Revision 5 - January 1979	01/29/79	02/01/79
Revision 6 - February 1979	02/27/79	03/06/79
Revision 7 - March 1979	03/30/79	03/30/79
Revision 8 - April 1979	04/30/79	05/03/79
Revision 9 - June 1979	06/29/79	

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
VOLUME I					
i	3	1.1-17	7	(3 of 4)	7
ii	3	1.1-18	7	(4 of 4)	7
iii	0	1.1-19	7	Tbl 1.1-12	7
iv	0	1.1-20	7	Tbl 1.1-13	7
v	0	1.1-21	7	Tbl 1.1-14	2
LOEP-1	9	1.1-22	7	Fig 1.1-1	2
LOEP-2	7	1.1-23	7	Fig 1.1-2	2
LOEP-3	9	1.1-24	7	Fig 1.1-3	2
LOEP-4	9	1.1-25	7	1.2-1	3
LOEP-5	9	1.1-26	7	1.3-1	7
LOEP-6	9	1.1-27	7	1.3-2	4
LOEP-7	9	1.1-28	7	Tbl 1.3-1	7
LOEP-8	9	1.1-29	7	Tbl 1.3-2	7
LOEP-9	9	1.1-30	7	2-i	0
LOEP-10	9	1.1-31	7	2-ii	0
LOEP-11	9	1.1-32	7	2-iii	2
1-i	7	1.1-33	7	2-iv	3
1-ii	4	1.1-34	7	2-v	4
1-iii	2	1.1-35	7	2-vi	0
1.1-1	2	1.1-36	7	2-vii	0
1.1-2	7	Tbl 1.1-1	7	2-viii	0
1.1-3	7	Tbl 1.1-2	7	2-ix	3
1.1-4	7	Tbl 1.1-3	7	2.1-1	0
1.1-5	7	Tbl 1.1-4	7	2.1-2	0
1.1-6	7	Tbl 1.1-5	4	2.1-3	0
1.1-7	7	Tbl 1.1-6	4	2.1-4	0
1.1-8	7	Tbl 1.1-7	4	2.1-5	1
1.1-9	7	Tbl 1.1-8	4	2.1-6	1
1.1-10	7	Tbl 1.1-9	7	2.1-7	0
1.1-11	7	Tbl 1.1-10		2.1-8	0
1.1-12	7	(1 of 2)	2	2.1-9	1
1.1-13	7	(2 of 2)	2	2.1-10	1
1.1-14	7	Tbl 1.1-11		2.1-11	0
1.1-15	7	(1 of 4)	2	2.1-12	0
1.1-16	7	(2 of 4)	2	2.1-13	[illegible]
				2.1-14	[illegible]

283

320

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
2.1-14a	1	Tbl 2.1-19		2.2-10	1
2.1-14b	1	(1 of 2)	1	2.2-11	0
2.1-15	1	(2 of 2)	1	2.2-12	1
2.1-16	0	Tbl 2.1-20	1	2.2-13	0
2.1-17	0	Tbl 2.1-21	1	2.2-14	0
2.1-18	2	Tbl 2.1-22	1	2.2-15	1
2.1-19	1	Tbl 2.1-23	1	2.2-16	0
2.1-20	0	Tbl 2.1-24	1	2.2-17	1
2.1-21	1	Tbl 2.1-25	1	2.2-18	0
2.1-22	1	Fig 2.1-1	0	2.2-19	0
2.1-23	1	Fig 2.1-2	0	2.2-20	0
2.1-23a	1	Fig 2.1-3	0	2.2-21	0
2.1-23b	1	Fig 2.1-4	0	Tbl 2.2-1	0
2.1-24	0	Fig 2.1-5	0	Tbl 2.2-1a	7
2.1-25	0	Fig 2.1-6	0	Tbl 2.2-2	
2.1-26	1	Fig 2.1-7	0	(1 of 3)	0
2.1-27	1	Fig 2.1-8	0	(2 of 3)	0
2.1-28	2	Fig 2.1-9	0	(3 of 3)	0
2.1-29	1	Fig 2.1-10	0	Tbl 2.2-3	0
2.1-30	1	Fig 2.1-11	0	Tbl 2.2-4	0
2.1-31	1	Fig 2.1-12	0	Tbl 2.2-5	1
2.1-32	1	Fig 2.1-13	0	Tbl 2.2-6	1
2.1-33	1	Fig 2.1-14	0	Tbl 2.2-7	
2.1-34	0	Fig 2.1-15	0	(1 of 2)	0
Tbl 2.1-1	0	Fig 2.1-16	0	(2 of 2)	0
Tbl 2.1-2	0	Fig 2.1-17	0	Tbl 2.2-8	
Tbl 2.1-3	0	Fig 2.1-18	0	(1 of 2)	0
Tbl 2.1-4	0	Fig 2.1-19	0	(2 of 2)	0
Tbl 2.1-5	0	Fig 2.1-20	0	Fig 2.2-1	0
Tbl 2.1-6	0	Fig 2.1-21	0	Fig 2.2-2	0
Tbl 2.1-7	0	Fig 2.1-22	0	Fig 2.2-3	0
Tbl 2.1-8	1	2.1R-1	1	Fig 2.2-4	0
Tbl 2.1-9	0	2.1R-2	0	2.2R-1	7
Tbl 2.1-10	1	2.1R-3	0	2.2R-2	0
Tbl 2.1-11	0	2.1R-4	1	App 2.2A	NA
Tbl 2.1-12	0	2.1R-5	1	App 2.2B	NA
Tbl 2.1-13	0	2.2-1	1	App 2.2C	NA
Tbl 2.1-14	0	2.2-2	5	2.3-1	0
Tbl 2.1-15	0	2.2-2a	4	2.3-2	0
Tbl 2.1-16		2.2-2b	4	2.3-3	1
(1 of 3)	1	2.2-3	1	2.3-4	0
(2 of 3)	0	2.2-4	1	2.3-5	1
(3 of 3)	1	2.2-5	1	2.3-6	1
Tbl 2.1-17	1	2.2-6	0	2.3-7	0
Tbl 2.1-18	1	2.2-7	1	2.3-8	0
		2.2-8	1	2.3-9	0
		2.2-9	1		

NA = Not applicable. This appendix was not written by Consumers Power Company or its contractors.

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
2.3-10	0	2.3R-3	1	Tbl 2.4-3	0
2.3-11	0	App 2.3A		Tbl 2.4-4	0
2.3-12	0	2.3A Title Pg	0	Tbl 2.4-5	0
2.3-13	0	2.3A-i	0	Tbl 2.4-6	0
2.3-14	0	Tbl 2.3A-1	0	Tbl 2.4-7	2
2.3-15	0	Tbl 2.3A-2	0	Tbl 2.4-8	
2.3-16	0	Tbl 2.3A-3	0	(1 of 4)	0
2.3-17	1	Tbl 2.3A-4	0	(2 of 4)	0
2.3-18	4	Tbl 2.3A-5	0	(3 of 4)	0
2.3-19	0	Tbl 2.3A-6	0	(4 of 4)	0
2.3-20	0	Tbl 2.3A-7	0	Tbl 2.4-9	
2.3-21	0	Tbl 2.3A-8	0	(1 of 5)	0
Tbl 2.3-1	0	Tbl 2.3A-9	0	(2 of 5)	0
Tbl 2.3-2	0	Tbl 2.3A-10	0	(3 of 5)	0
Tbl 2.3-3	0	2.4-1	0	(4 of 5)	0
Tbl 2.3-4	[illegible]	2.4-2	1	(5 of 5)	0
Tbl 2.3-5	0	2.4-3	1	Tbl 2.4-10	0
Tbl 2.3-6	0	2.4-4	[illegible]	Tbl 2.4-11	2
Tbl 2.3-7	0	2.4-5	1	Fig 2.4-1	0
Tbl 2.3-8	0	2.4-6	0	Fig 2.4-2	0
Tbl 2.3-9	0	2.4-7	0	Fig 2.4-3	0
Tbl 2.3-10	0	2.4-8	0	Fig 2.4-4	0
Tbl 2.3-11	0	2.4-9	0	Fig 2.4-5	0
Tbl 2.3-12	0	2.4-10	9	Fig 2.4-6	0
Tbl 2.3-13	0	2.4-11	1	Fig 2.4-7	0
Tbl 2.3-14	0	2.4-12	1	Fig 2.4-8	0
Tbl 2.3-15	0	2.4-13	1	Fig 2.4-9	0
Tbl 2.3-16	0	2.4-14	0	Fig 2.4-10	0
Tbl 2.3-17	0	2.4-15	2	Fig 2.4-11	0
Tbl 2.3-18	0	2.4-15a	2	Fig 2.4-12	2
Fig 2.3-1	0	2.4-15b	2	2.4R-1	1
Fig 2.3-2	0	2.4-16	0	2.4R-2	1
Fig 2.3-3	0	2.4-17	0	2.4R-3	0
Fig 2.3-4	0	2.4-18	2	2.5-1	0
Fig 2.3-5	0	2.4-19	2	2.5-2	2
Fig 2.3-6	0	2.4-20	1	2.5-3	0
Fig 2.3-7	0	2.4-21	0	2.5-4	2
Fig 2.3-8	0	2.4-22	0	2.5-5	1
Fig 2.3-9	0	2.4-23	2	2.5-6	0
Fig 2.3-10	0	2.4-23a	2	Tbl 2.5-1	0
Fig 2.3-11	0	2.4-23b	2	Fig 2.5-1	0
Fig 2.3-12	0	2.4-24	2	Fig 2.5-2	0
Fig 2.3-13	0	2.4-25	0	Fig 2.5-3	0
2.3R-1	1	Tbl 2.4-1	0	Fig 2.5-4	0
2.3R-2	0	Tbl 2.4-2	0	Fig 2.5-5	0

288 ~~319~~ 322 BRW

Sheet ID	Latest Rev
Fig 2.5-6	0
Fig 2.5-7	0
2.5R-1	1
2.5R-2	1
VOLUME II	
i	4
ii	4
iii	0
iv	0
v	0
2.6-1	9
2.6-2	3
2.6-3	3
2.6-4	6
2.6-5	6
Fig 2.6-1	3
2.6R-1	3
App 2.6A	NA
App 2.6B	NA
App 2.6C	NA
2.7-1	0
2.7-2	0
Fig 2.7-1	0
Fig 2.7-2	0
Fig 2.7-3	0
Fig 2.7-4	0
Fig 2.7-5	0
Fig 2.7-6	0
3-i	2
3-ii	2
3-iii	0
3-iv	6
3-v	2
3.1-1	0
3.1-2	1
3.1-3	1
3.1-4	0
3.1-5	0
3.1-6	0
3.1-7	0
Tbl 3.1-1	
(1 of 2)	0
(2 of 2)	0
Fig 3.1-1	0
Fig 3.1-2	0
Fig 3.1-3/ Fig 3.1-4	0

Sheet ID	Latest Rev
Fig 3.1-5	0
Fig 3.1-6	0
3.1R-1	1
3.2-1	1
3.2-2	3
3.2-3	3
Fig 3.2-1	1
Fig 3.2-2	3
3.3-1	8
3.3-1a	2
3.3-1b	2
3.3-2	6
3.3-3	0
Tbl 3.3-1	
(1 of 2)	9
(2 of 2)	9
Tbl 3.3-2	8
Fig 3.3-1	8
3.4-1	9
3.4-2	9
3.4-3	9
3.4-4	0
3.4-5	2
3.4-6	9
3.4-7	2
3.4-7a	2
3.4-7b	2
3.4-8	9
3.4-9	9
3.4-10	9
3.4-11	9
Tbl 3.4-1	0
Tbl 3.4-2	1
Tbl 3.4-3	2
Tbl 3.4-4	0
Tbl 3.4-5	0
Tbl 3.4-6	6
Tbl 3.4-7	7
Tbl 3.4-8	2
Fig 3.4-1	0
Fig 3.4-2	0
Fig 3.4-3	3
Fig 3.4-4	0
Fig 3.4-5	0
Fig 3.4-6	0
Fig 3.4-7	0

Sheet ID	Latest Rev
Fig 3.4-8	0
Fig 3.4-9	3
Fig 3.4-10	2
3.4R-1	9
3.5-1	1
3.5-2	0
3.5-3	1
3.5-4	1
3.5-5	1
3.5-6	1
3.5-7	0
3.5-8	0
3.5-9	0
3.5-10	0
3.5-11	0
3.5-12	0
3.5-13	1
3.5-14	0
3.5-15	0
3.5-16	1
3.5-17	0
3.5-18	0
3.5-19	0
3.5-20	0
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3.5-28	0
3.5-29	0
3.5-30	1
3.5-31	1
Tbl 3.5-1	0
Tbl 3.5-2	
(1 of 2)	0
(2 of 2)	0
Tbl 3.5-3	
(1 of 2)	0
(2 of 2)	0
Tbl 3.5-4	0
Tbl 3.5-5	0
Tbl 3.5-6	0

NA = Not applicable. This appendix was not written by Consumers Power Company or its contractors.

Sheet ID	Latest Rev
Tbl 3.5-7	1
Tbl 3.5-8	
(1 of 2)	0
(2 of 2)	0
Tbl 3.5-9	0
Tbl 3.5-10	1
Tbl 3.5-11	0
Tbl 3.5-12	0
Tbl 3.5-13	
(1 of 4)	1
(2 of 4)	0
(3 of 4)	1
(4 of 4)	0
Fig 3.5-1	0
Fig 3.5-2	0
3.5R-1	1
App 3.5A	
3.5A Title Pg	0
3.5A-i	0
3.5A-ii	0
3.5A-iii	0
3.5A-1	0
3.5A-2	0
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3.5A-6	0
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3.5A-10	0
3.5A-11	0
3.5A-12	0
3.5A-13	0
3.5A-14	0
3.5A-15	0
Tbl 3.5A-1	0
Tbl 3.5A-2	0
Tbl 3.5A-3	0
Tbl 3.5A-4	0
Tbl 3.5A-5	0
Tbl 3.5A-6	0
Tbl 3.5A-7	0
Tbl 3.5A-8	0
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Fig 3.5A-19	0
3.6-1	0
3.6-2	8
3.6-3	8
3.6-3a	1
3.6-3b	1
3.6-4	1
3.6-5	1
3.6-6	2
3.6-6a	7
3.6-6b	9
3.6-7	1
3.6-8	8
3.6-9	8
Tbl 3.6-1	0
Tbl 3.6-2	
(1 of 2)	8
(2 of 2)	8
Tbl 3.6-3	8
Tbl 3.6-4	9
Tbl 3.6-5	0
Tbl 3.6-6	
(1 of 2)	8
(2 of 2)	8
3.6R-1	9
3.7-1	0
3.7-2	4
3.7-2a	4
3.7-2b	4
3.7-3	0
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3.7-5	0
3.8-1	0
3.8R-1	0
3.9-1	0
3.9-2	1
3.9-3	9
3.9-4	1
3.9-5	1
3.9-6	0
3.9-7	1
3.9-8	1
3.9-9	1
3.9-10	1
3.9-11	4
3.9-12	4
3.9-13	1
3.9-14	0
3.9-15	0
Tbl 3.9-1	5
Tbl 3.9-2	0
Fig 3.9-1	0
Fig 3.9-2	0
Fig 3.9-3A	0
Fig 3.9-3B	0
Fig 3.9-3C	0
Fig 3.9-3D	0
Fig 3.9-3E	0
Fig 3.9-3F	0
Fig 3.9-3G	0
Fig 3.9-3H	0
Fig 3.9-4	0
Fig 3.9-5	0
Fig 3.9-6	0
Fig 3.9-7	0
Fig 3.9-8	0
Fig 3.9-9	5
3.9R-1	1
3.9R-2	1
3.9R-3	1

288 [illegible] 324

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
4-i	0	5.1-8	9	Fig 5.1B-4	0
4-ii	4	5.1-9	9	Fig 5.1B-5	0
4.1-1	1	5.1-10	9	5.1BR-1	9
4.1-2	1	5.1-11	0	App 5.1C	NA
4.1-3	1	5.1-12	0	5.2-1	0
4.1-4	6	5.1-13	1	5.2-2	0
4.1R-1	1	5.1-14	0	5.2-3	0
4.2-1	0	5.1-15	0	5.2-4	0
4.2-2	9	5.1-16	0	5.2-5	0
4.2-3	4	5.1-17	0	5.2-6	0
4.2-4	4	5.1-18	1	5.2-7	0
4.2-5	4	5.1-19	0	5.2-8	0
4.2-6	4	5.1-20	0	5.2-9	0
4.2-7	4	5.1-21	1	5.2-10	0
4.2-8	4	Tbl 5.1-1	3	5.2-11	0
4.2-9	4	Tbl 5.1-3	1	5.2-12	0
Tbl 4.2-1	5	Fig 5.1-1	3	5.2-13	0
4.2R-1	1	Fig 5.1-2	3	5.2-14	0
4.2R-2	0	Fig 5.1-3	3	5.2-15	0
4.3-1	1	Fig 5.1-4	3	5.2-16	0
4.3-2	1	Fig 5.1-5	3	5.2-17	0
4.3-3	0	Fig 5.1-6	0	5.2-18	0
4.3-4	6	5.1R-1	1	5.2-19	[illegible]
4.3-5	0	5.1R-2	1	5 2-20	0
4.3-6	1	5.1R-3	9	5.2-21	0
4.3R-1	0	App 5.1A	NA	5.2[illegible]	7
4.4-1	0	App 5.1B		5.2-23	7
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4 [illegible]R-1	0	5.1B-ii	0	5.2-26	0
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5-ii	4	5.1B-3	1	5.2-30	0
5-iii	0	5.1B-4	1	5.2-31	1
5-iv	3	5.1B-5	0	5.2-32	1
5-v	4	5.1B-6	0	5.2-33	0
5-vi	3	5.1B-7	0	5.2-34	1
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5.1-4	0	Tbl 5.1B-2	0	Tbl 5.2-2	0
5.1-5	0	Fig 5.1B-1	0	Tbl 5.2-3	0
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5.1-6a	8	Fig 5.1B-3	0	Tbl 5.2-5	0
5.1-6b	8				
5.1-7	7				

NA = Not applicable. This appendix was not written by Consumers Power Company or its contractors.

288 324 325

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
Tbl 5.2-6	0	5.5-7	4	VOLUME III	
Tbl 5.2-7	0	5.5-8	4	i	4
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Tbl 5.2-11	0	5.5R-3	4	v	0
Tbl 5.2-12	0	5.6-1	4	6-i	7
Tbl 5.2-13	1	5.6-1a	4	6-ii	5
Tbl 5.2-14	9	5.6-1b	4	6-iii	5
Tbl 5.2-15	9	5.6-2	3	6-iv	7
Tbl 5.2-16	9	5.6-3	8	6-v	5
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Fig 5.2-1	0	5.6A Title Pg 2	0	6.1-8	2
Fig 5.2-2	0	5.6A-i	0	6.1-9	2
Fig 5.2-3	0	5.6A-1	0	6.1-10	0
Fig 5.2-4	0	5.6A-2	0	6.1-11	1
Fig 5.2-5	0	5.6A-3	0	6.1-12	0
Fig 5.2-6	0	5.6A-4	0	6.1-13	0
Fig 5.2-7	0	5.6A-5	0	6.1-14	0
Fig 5.2-8	0	5.6A-6	0	6.1-15	0
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Fig 5.2-10	0	App A (2 of 2)	0	6.1-17	1
Fig 5.2-11	0	App B Title Pg	0	6.1-18	2
Fig 5.2-12	0	App B (1 of 2)	0	6.1-18a	2
5.2R-1	0	App B (2 of 2)	0	6.1-18b	2
5.2R-2	9	App C Title Pg	0	6.1-19	0
5.2R-3	1	App C (1 of 7)	0	6.1-20	0
5.2R-4	1	App C (2 of 7)	0	6.1-21	0
5.3-1	8	App C (3 of 7)	0	6.1-22	1
5.3-2	3	App C (4 of 7)	0	6.1-23	1
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5.3R-1	0	App C (6 of 7)	0	6.1-25	2
5.4-1	1	App C (7 of 7)	0	6.1-26	3
5.5-1	0	5.7-1	0	6.1-27	7
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5.5-3	0	5.8-1	6	6.1-27b	7
5.5-4	0	5.8-2	0	6.1-28	7
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5.5-6	4	5.8R-1	6		
		5.9-1	0		

288 326

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
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Tbl 6.1-4	0	6.2A-2-8	0	Tbl 6.2A-3-10	7
Tbl 6.1-5	0	6.2A-2-9	0	Tbl 6.2A-3-11	7
Tbl 6.1-6	0	6.2A-2-10	8	6.2A-3R-1	1
Tbl 6.1-8	0	6.2A-2-11	0	6.2A-3R-2	7
Fig 6.1-1	3	6.2A-2-12	0	6.2A-4-1	0
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Fig 6.1-3	2	6.2A-2-14	0	6.2A-5-2	0
Fig 6.1-4	1	6.2A-2-15	0	6.2A-5-3	0
Fig 6.1-5	0	6.2A-2-16	0	6.2A-5-4	0
Fig 6.1-6	0	6.2A-2-17	0	6.2A-5-5	0
Fig 6.1-7	0	6.2A-2-18	0	6.2A-5-6	7
Fig 6.1-8	2	6.2A-2-19	0	6.2A-5-7	7
Fig 6.1-9	0	6.2A-2-20	0	6.2A-5-8	0
6.1R-1	1	Tbl 6.2A-2-1	0	6.2A-5-9	0
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6.2-2	0	Tbl 6.2A-2-5	0	Fig 6.2A-5-1	0
6.2-3	2	6.2A-2R-1	1	6.2A-5R-1	0
6.2-3a	2	6.2A-3-1	9	App 6.2A-5A	
6.2-3b	2	6.2A-3-2	9	6.2A-5A-1	0
6.2-4	2	6.2A-3-3	0	6.2A-5A-2	0
6.2-5	0	6.2A-3-4	0	6.2A-5A-3	0
6.2-6	0	6.2A-3-5	2	6.2A-5A-4	0
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6.2A-iv	0	6.2A-3-10	7	6.2A-5A-11	0
6.2A-1-1	0	6.2A-3-11	7	Tbl 6.2A-5A-1A	0
6.2A-1-2	0	6.2A-3-12	4	Tbl 6.2A-5A-1B	0
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6.2A-1-5	0	6.2A-3-15	7	Tbl 6.2A-5A-2B	0
6.2A-1-6	0	6.2A-3-16	7	Tbl 6.2A-5A-3	0
6.2A-1-7	0	6.2A-3-17	7	Tbl 6.2A-5A-4A	0
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288 ~~323~~ 327

Sheet ID	Latest Rev	Sheet ID	Latest Rev	Sheet ID	Latest Rev
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7.1-10	0	8.1-3	7	(2 of 13)	9
7.1-11	0	8.1-4	0	(3 of 13)	9
7.1-12	0	8.1R-1	7	(4 of 13)	8
7.1-13	0	8.2-1	7	(5 of 13)	8
7.1-14	0	8.2-1a	7	(6 of 13)	9
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288 328

Sheet ID	Latest Rev
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Q&R iii	9
Q&R iv	7
Q&R v	5
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AEC 4-1	2

Sheet ID	Latest Rev
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HYD 3-1	2
HYD 4-1	3

288 ~~328~~ 328
329

Sheet ID	Latest Rev
HYD 5-1	9
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SOC 18-1	3
SOC 18-2	3
TEC 1-1	2
TEC 2-1	7
TEC 3-1	7
TEC 4-1	4
TEC 5-1	3

288 326 330

for a possible "domino" effect in the failure of the upstream dams, the total storage behind all four dams could be treated as concentrated at the dam farthest downstream, Sanford Dam.

A failure hydrograph at Sanford Dam was developed[2] and routed by the storage coefficient method[2] through the Tittabawassee River to the Midland Plant, using an average velocity of 3.5 ft/s, time increments of 6 hours, and channel storage coefficient of 0.10. The assumed velocity and coefficient are considered appropriate for the PMF condition.

Figure 2.4-6 shows the channel routed hydrograph. As presented in FSAR Section 2.4.3, dam failure occurs early on the rising limb of the flood hydrograph and reduces the significance of the routing coefficients. The dam breach is actually a relatively minor contribution to the total peak flow past the Plant. By adding the routed dam failure hydrograph to the natural PMF at the Plant, a combined peak flow of approximately 262,000 cfs results.

The possibility of a simultaneous occurrence of two flood peaks resulting from a seismically induced dam break and a runoff flood was investigated. In Figure 2.4-6, the total peak discharge resulting from the addition of the dam failure peak (63,000 cfs) with the estimated standard project flood peak (half of the PMF, ie, 124,000 cfs) yields a total flood discharge of 187,000 cfs at the Plant. The flood level from this combination of events is lower than the PMF level.

2.4.4.5 Maximum Water Level

To determine the water level that would result at the Plant site from the PMF peak discharge of 262,000 cfs (which includes the upstream dam failure), rating curve calculations were made using conservative channel and flood plain flow resistance and downstream water levels. Calculations were made using a US Corps of Engineers originated computer program(6) which incorporates the standard step backwater method. From the rating curve and the PMF discharge hydrograph, the PMF stage hydrograph at the Plant is developed which shows that the peak water level in the Tittabawassee River under postconstruction conditions would be at about 631 feet msl.

2.4.5 Low Flow Considerations

2.4.5.1 Low Flow in the Tittabawassee River

Although the river flow is not related to the continued safety of the Midland
Plant, it is related to the continuous electrical generating capability.
Based on a detailed study of river discharges, a 100-day drought was
established as the design criteria for sizing the cooling pond(2). The
quantity of water which may be withdrawn from the river for use as makeup to
1 the pond is a function of the river flow rate as presented in Table 3.4-6.

It is anticipated that during an average year the withdrawal rate will be
about 46 cfs. Twenty-eight cfs will be required to replace pond losses and
9 the remainder (18 cfs) is available for blowdown. The pond losses consist of
an average monthly evaporation rate of 27.5 cfs with the remainder allowed for
seepage losses. The evaporation losses were determined using empirical
methods based on monthly wind speed and air vapor pressure data(7). The
meteorological data were obtained from weather stations at Midland and
Saginaw, Michigan. Blowdown is returned to the river. During initial filling
1 of the pond, all river water in excess of 350 cfs in accordance with Table
3.4-6, up to a withdrawal rate of 134 cfs, is withdrawn until the pond is

2.6 REGIONAL HISTORIC, ARCHAEOLOGICAL, SCENIC, CULTURAL, AND NATURAL FEATURES

The following sections contain information relating to earlier archeological activities and to present investigations. Much of the archeological information for the construction permit stage is contained in various letters. The content of the letters is summarized in Section 2.6.1 and the letters are provided in Appendix 2.6A.

There are no historic or archeological sites listed in either the State nor National Register of Historic Places in the area of the Midland Plant
3 (refer to Appendix 2.6A). The nearest site listed in the National Register of Historic Places is located about 15 miles (24 km) to the east in Bay City.

The Saginaw Valley and the Midland area are, however, rich in archaeology as described by Dr James Fitting (refer to Appendix 2.6B).

2.6.1 <u>Construction Permit Stage</u>

A May 4, 1972 letter from the State Historic Preservation Coordinator indicated that there was not a large archeological site in the area that had not been destroyed by prior extensive earth disturbing activities. Consumers Power, in 1977 and 1978, sent letters to Mr Foster, Mr Thompson, Ms Wang, and
9 Mr Pomranky (all associated with Saginaw Valley Chapter of the Michigan Archaeological Society) requesting any information they might have relating to 1971 archeological investigations of the Midland Plant site.

3 Mr Pomranky's reply indicated only a brief investigation of the area and only a few flint chips found (actually on Dow property). Mr Pomranky did not

recall any prehistoric occupation sites and did not believe the area warranted any further exploration.

Ms Wang's response noted the involvement of State Historic Preservation Coordinator, the Curator of Anthropology at Michigan State University, a Bay City amateur archaeologist and a Midland amateur archaeologist. Her letter stated that 90% of the Plant site had been destroyed before the archaeological investigation was made.

A subsequent Consumers Power telephone discussion with John Woodworth of Midland, Michigan (refer to confirming letter of August 3, 1978, and memo in Appendix 2.6A) provided information on the personnel involved in the survey, the few materials found and the fact that a 10 feet x 10 feet (3 m x 3 m) pit
3 had been excavated through the plow zone with negligible findings. Mr Woodworth had submitted a report to Dr Cleland at Michigan State University who indicated in an April 6, 1972 letter his intent to forward the report to the State Historic Preservation Coordinator. The report was not sent to Consumers Power and at present no copy can be found in the records of Mr Woodworth or the State Archaeologist or the Curator of Anthropology at Michigan State University.

Dr Cleland remarks that the site had been destroyed. Several of the letters from the amateur archaeologists and also the May 4, 1972 letter from the State Historic Preservation Coordinator assert that tentative arrangements had been made by the amateur archaeologists with Consumers Power to be informed prior to topsoil stripping in the area of the old county farm (the area is now under water within the cooling pond). Consumers Power has no records of any such

TABLE 3.3-1 1 of 2

9 | WATER USAGE[j]
(1,000s of gallons per day)

Rev.	Node[e]	Maximum Power[a] Average Flow	Maximum Power[a] Maximum Flow	Minimum Power[b] Average Flow	Minimum Power[b] Maximum Flow	Temporary Shutdown[c] Average Flow	Temporary Shutdown[c] Maximum Flow
	1	40.9	2,130	40.9	2,130	40.9	2,130
	2	9.4	490	9.4	490	9.4	490
	3	31.3	1,730	31.3	1,730	31.3	1,730
7	4	1,960[d]	103,000	1,960[d]	103,000	1,960[d]	103,000
	5	28,000[d]	174,500	28,000[d]	174,500	28,000[d]	174,500
8	6	(i)	43,360	(i)	43,360	(i)	43,360
	7	11,700[d]	142,000	11,700[d]	142,000	11,700[d]	142,000
	8	323	323	323	323	323	323
	9	18,000[d]	54,700[f]	10,200	16,500[f]	7,200	13,000[f]
8	10	(i)	303	(i)	303	(i)	303
	11	942,700	942,700	735,000	735,000	380,600	380,600
7	12	942,700	942,700	735,000	735,000	380,600	380,600
	13	53,780	53,780	53,780	53,780	53,780	53,780
	14	(i)	53,780	(i)	53,780	(i)	53,780
	15	(i)	3	(i)	3	(i)	3
8	16	(i)	839	(i)	839	(i)	839
	17	(i)	48,430	(i)	48,430	(i)	48,430
	18	(i)	4,510	(i)	4,510	(i)	4,510
	19	53,780	53,780	53,780	53,780	53,780	53,780
7	20	6,900	6,900	6,900	6,900	6,900	6,900
3	21	2.4 (10^6) lb/hr	2.4 (10^6) lb/hr	2.4 (10^6) lb/hr	2.4 (10^6) lb/hr	2.4 (10^6) lb/hr	2.4 (10^6) lb/hr
7	22	35	115	35	115	35	115
9	23	124	779	124	779	48	779
7	24	15.5	30	15.5	30	15.5	30
9	25	141	814	141	814	65	814
7	26	15	30	15	30	15	30
8	27	0.6	3.0	0.6	3.0	0.6	3.0
	28	0.5	1.0	0.5	1.0	0.5	1.0
9	29	124	779	124	779	48	779
	30	0.5	1.0	0.5	1.0	0.5	1.0
	31	10	20	10	20	5	10
8	32	(i)	19	(i)	19	(i)	19
7	33	<1	<1	<1	<1	<1	<1
9	34	112	720	112	720	42	720
	35	2.4	4.2	2.4	4.2	2.4	4.2
9	36	9	55	9	55	3.4	55
8	37	(i)	19	(i)	19	(i)	19
	38	13,000	13,000	13,000	13,000	13,000	13,000

TABLE 3.3-1 2 of 2

		Maximum Power(a)		Minimum Power(b)		Temporary Shutdown(c)	
	Node(e)	Average Flow	Maximum Flow	Average Flow	Maximum Flow	Average Flow	Maximum Flow
	39	13,000	13,000	13,000	13,000	13,000	13,000
	40	0.4	4.4	0.4	4.4	0.4	4.4
7	41	41,300	41,300	26,300	26,300	21,200	21,200
	42	41,300	41,300	26,300	26,300	21,200	21,200
	43	44	150	44	150	7.4	74
9	44	29	97	29	97	4.8	48
	45	16	53	16	53	3.1	27
7	46	2.6	3.5	2.6	3.5	2.6	3.5
9	47	9	74	9	74	3.4	74
	48	1	48	1	48	1	48
7	49	64	118	64	118	64	118
	50	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
7	51	64	288	64	288	64	288
8	52	0.6	2.0	0.6	3.0	0.6	2.0
	53	Not Used					
	54	Not Used					
8	55	2.1	(h)	2.1	(h)	2.1	(h)
	56	0.8	1.4	0.8	1.4	0.8	1.4
	57	0.8	1.4	0.8	1.4	0.8	1.4
9	58	(i)	3.0	(i)	3.0	(i)	3.0
1	59	0.2	20	0.2	20	0.2	20
8	60	11,800(d)	142,000	11,800(g)	142,000	11,800(g)	142,000
	consumption						
	8 + 9 + 55	18,300	55,000	10,500	16,800	7,500	13,300
8	15 + 16	(i)	842	(i)	842	(i)	842

(a) Unit 1 operating in the valves' wide open throttle condition with the turbine at back end limited load, and Unit 2 operating in the valves' wide open throttle condition.

7 (b) Unit 2 operating at 25% of rated power; Unit 1 operating in the valves' wide open throttle condition with the turbine at back end limited load.

(c) Unit 2 temporarily shut down; Unit 1 operating in the valves' wide open throttle condition with the turbine at back end limited load.

(d) See Table 3.3-2.

(e) See Figure 3.3-1.

(f) Computed for the average meteorological conditions of July 1946 and the average wind speed of March 1950. Among the metoeorological data recorded at Lansing, Michigan, from 1910-1976, the month of July 1946 has the maximum dew point depression and the month of March 1950 has the highest wind speed.

(g) Minimum power and temporary shutdown are not expected to be of sufficient duration to affect the average flows presented in Table 3.3-2.

(h) Not determined.

8 (i) Average flow of zero due to intermittent flow. Maximum flow is stated in this Table.

9 (j) Data do not take refueling periods into account for either unit.

288 336

3.4 HEAT DISSIPATION SYSTEM

The circulating and service water flow schemes for the principal heat removal facilities built for Midland Plant Units 1 and 2 are illustrated in Figures 3.4-1 and 3.4-2. The cooling pond shown in Figure 3.4-3 acts as a natural
9| boundary to isolate the Tittabawassee River from directly receiving the water discharged from heat removal facilities. The cooling pond makeup and blowdown
9| systems are provided to maintain the cooling pond TDS within acceptable operating limits. These systems are illustrated in Figures 3.4-7, 3.4-8 and 3.4-9.

3.4.1 Circulating Water System

Two half-capacity circulating water pumps are provided per unit, rated 132,135 gpm each for Unit 1 and 195,200 gpm each for Unit 2. These pumps take suction from the cooling pond and circulate the water through the tube side of the condensers and discharge it back to the cooling pond. The circulating water picks up heat in the condensers by condensing the turbine exhaust steam. Heat is dissipated from the cooling pond to the atmosphere by evaporation, radiation, and sensible conduction. The circulating water system and condenser design characteristics are given in Table 3.4-1. The circulating water intake structure is adjacent to the service water pump structure on the cooling pond as illustrated in Figure 3.4-4. Trash racks and stationary screens with a 7/16-inch (11 mm) mesh are provided at the entrance to the pump suction pit. The water velocity at the entrance is less than 0.5 ft/s (15 cm/s). Water in the circulating water piping reaches a velocity of 8-10 ft/s (2.4 to 3 m/s).

Motor-operated butterfly valves are provided in each circulating water pipeline at the circulating water pump discharge and the circulating water system discharge structure. These valves are provided for condenser and circulating water pipe maintenance. The valves at the pump discharge are also used for start-up. Each circulating water pump for Unit 1 discharges through a separate 72-inch (183-cm) pipe through each half of the condenser water boxes, and then through two separate 72-inch (183-cm) pipes into the cooling pond. Each circulating water pump for Unit 2 discharges into a separate 96-inch (244-cm) pipe directly into the low-pressure condenser water boxes, then into the high-pressure condenser water box and into the cooling pond through two separate 96-inch (244-cm) pipes via the circulating water discharge structures shown in Figure 3.4-4. Cross-connects are provided on both units to allow pump runout through both piping flow paths if one pump is inoperative. Figure 3.4-10 is a detail drawing of the circulating discharge structure for Unit 1; the Unit 2 structure is similar in design.

Sodium hypochlorite is injected into the circulating water to control biological growth on the condenser tube walls as discussed in Section 3.6. Sulfuric acid injection keeps the pH level of circulating water at a value which minimizes scaling and is discussed in Section 3.6.

3.4.2 Service Water System

The service water system is considered a shared system and is comprised of two redundant essential service water trains and two turbine building service water trains. The service water system provides treated cooling water for various components during normal Plant operation and also provides cooling water to the engineered safety features equipment and a backup water supply
1 for several safety-related systems during normal Plant operation or a design

basis accident. Each essential service water train serves one-half the safety-related cooling components of both units. Each turbine building service water train serves all of the components of one unit's turbine building.

Each of the five service water pumps has a capacity of 20,500 gpm. The pumps are the vertical wet pit mixed flow type and are installed in the service water pump house. One essential service water train and one turbine building service water train are serviced by two pumps, with one common spare installed between the two pairs of pumps serving as a backup for both trains.

9 The emergency cooling water reservoir is provided in the bottom of the cold
leg of the cooling pond as illustrated in Figure 3.4-3. Upon loss of the main
cooling pond, water would be supplied via an open channel from the emergency
cooling water reservoir to the service water structure. As shown in
9 Figure 3.4-5, this flow of water would also pass through the trash racks and
traveling screens before entering the suction pool.

Two full capacity screen wash pumps are installed at the service water pump house forebay. The velocity of water flow coming into the structure from the emergency cooling water reservoir is normally less than 0.5 ft/s (15 cm/s). The bottom elevation of the intake structure is 3 feet (0.9 m) below the bottom elevation of the emergency cooling water reservoir. The discharge line from the service water system is exhausted into the emergency cooling water reservoir by two concrete discharge structures rising from its bottom as shown in Figure 3.4-4. The discharge structures have openings at their tops to promote uniform flow in the emergency cooling water reservoir.

The service water system operates in a closed cycle employing a mechanical draft cooling tower, as necessary to maintain the service water system design inlet temperature below 95°F (34.4°C). It is anticipated that the mechanical draft cooling tower will be in operation during parts of June, July, August and September. The service water tower is of the counterflow type. The service water system and the service water cooling tower design characteristics are given in Table 3.4-2.

When the service water cooling tower is operated during summer months, two full capacity, vertical wet pit type makeup pumps are used, one normally operating and one on standby. During this mode, the service water system is isolated from the cooling pond by closing the sluice gates between the pump house structure forebay and the service water pump pit. Under this condition the service water makeup pump provides makeup water to the system by taking suction from the pump house structure forebay and discharging into the pump pit. Each makeup pump has a capacity of 1,860 gpm for making up the cooling tower evaporation and blowdown loss. Overflow openings are provided on the separation wall between pit and forebay to allow excess makeup water to flow back to the forebay from the pump pit.

3.4.3 Cooling Pond

The cooling pond is an artificially created water body with an area of 880 acres (356 ha) and a design volume of 12,600 acre-feet. The pond is used to dissipate the heat, rejected by the circulating and service water systems, to the atmosphere. Plant heat rejection to the pond will vary from 7.69×10^9 Btu/hr under maximum guaranteed load (MGL) with both units in operation (service water cooling tower operating) to 9.05×10^9 Btu/hr for Unit 1 back end limited and Unit 2 with valves wide open (VWO) (service water cooling tower not operating). The cooling pond is illustrated in Figure 3.4-3.

2 The main purpose of the cooling pond is to provide a closed loop to supply and receive cooling water for the circulating and service water systems. The cooling pond also provides the source of water for the Plant fire protection system. The cooling pond has an internal baffle dike, which prevents direct flow of the circulating water discharge from the hot to the cold side of the pond and thus makes effective use of the entire cooling pond surface area. The general circulation patterns in the pond were determined by a physical model study[1] and are shown in Figure 3.4-6. The retention time of the cooling pond can be approximated by the ratio of the circulating water system flow divided by the usable storage of the pond and is equal to about three days.

The maximum operating water level in the pond is at elevation 627 feet msl (191 m) and the minimum operating level is at 618 feet msl (188 m). The surface areas at these elevations are 880 and 860 acres (356 and 348 ha), respectively. The pond storage volumes are 12,600 and 4,800 acre-feet for the maximum and minimum water levels in the pond, respectively. Of the total volume, approximately 7,800 acre-feet are considered usable during the 100-day drought. An additional 2,600 acre-feet are included to provide a 3-foot (0.9 m) minimum water depth. The pond bottom elevation varies from elevation 614 to 615 feet msl (187.1 to 187.5 m) which results in a minimum operating depth of 3 feet (0.9 m). The remaining storage volume of about 2,200 acre-feet includes the deeper areas in the eastern part of the pond below elevation 615 msl.

The emergency cooling water reservoir is located in the bottom of the cold end
of the cooling pond as illustrated in Figure 3.4-3. The emergency cooling
9 water reservoir contains 272 acre-feet of water, has an area of about 39
acres (16 ha) at elevation 604 feet msl (184 m) and a bottom elevation of
approximately 596 feet msl (182 m).

The usable cooling pond storage volume of 7,800 acre-feet is equal to the
estimated evaporative and seepage losses occurring during a 100-day drought.
Pond losses due to evaporation have been computed as approximately 8 feet
(2.4 m) or about 7,000 acre-feet during a 100-day drought. Pond losses due to
seepage are considered minimal (estimated to be about 0.[illegible] cfs). For design
purposes, a seepage loss of 4 cfs or approximately 800 acre-feet was assumed for
the 100-day design drought. During the 100-day drought, river conditions are
2 assumed which do not allow blowdown from the pond nor makeup flows to the pond.
This is due to the operating restrictions of each system as presented in
9 Sections 5.1.2 and 3.4.4, respectively. During this period, water for radwaste
2 dilution will be provided by the dilution line as described in Section 3.4.4.

The monthly average pond thermal performance was evaluated using a numerical model which simulated the steady-state heat balance of the pond with the atmosphere. The pond was represented by two horizontal well-mixed layers, a longitudinally advected heated layer at the surface and an underlying layer of returning backflow combined with ambient pond water. Heat transfer into the pond was the result of solar radiation, long wave atmospheric radiation, and the imposed heat load of the circulating water flow. Heat transfer out of the pond is through evaporation, back radiation, and sensible conduction. The pond heat loss due to evaporation was calculated using Meyer's evaporation equation[2].

288 ~~337~~ 342

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3.4.4 Cooling Pond Makeup System Structures

Cooling pond makeup water is taken from the Tittabawassee River through the
river intake structure illustrated in Figure 3.4-7. River water is supplied
from the river intake structure to the makeup pump structure shown in Figure
3.4-8 through a single 96-inch (244-cm) diameter pipe. Three cooling pond
makeup pumps, each having a nameplate rating of 31,500 gpm (70 cfs) capacity
6 and 40,400 gpm (90 cfs) maximum capacity at river levels exceeding 595 feet
msl, take suction from the common suction chamber of the makeup pump struc-
and discharge the river water into the cooling pond through a 72-inch (183-cm)
7 diameter concrete pipe. A dilution line (shown as Radwaste Dilution line on
Figure 3.3-1) is provided from the cooling pond makeup pumps to the cooling
pond discharge structure to provide minimum dilution flows for discharge of
6 low level radioactive effluents as described in Section 5.2.2.1.1.

Floating logs in front of the river intake structure prevent admission of
6 large floating debris. Vertical trash racks with 3-inch (7.6-cm) openings and
three traveling screens with 3/8-inch (9.5-mm) mesh size are provided for
further removal of smaller debris which would otherwise enter the river intake
6 structure. Disposal of debris is addressed in Section 3.7.

The design of the river intake structure features a natural bypass channel
9 which is intended to create a sweep flow in front of the traveling screens.
The bypass channel should provide an escape route for fish and help reduce
accumulation of debris and silt in front of the traveling screens.

6 The makeup water withdrawal regime as a function of river flow is listed in
Table 3.4-6. Furthermore, the average velocity of the withdrawn river water

approaching the screens, normal to the screens, should not exceed 1 ft/s (30cm/s). This is accomplished by operating the appropriate number of makeup pumps as illustrated in Table 3.4-7. Due to operational limitations of the
7 makeup pumps, water is recirculated back to the makeup pump suction to prevent river withdrawal above that permitted for makeup according to Table 3.4-6.

During initial filling of the pond, river water in excess of 350 cfs is
6 withdrawn until the pond is full. Two makeup pumps normally provide a minimum withdrawal rate of 140 cfs.

3.4.5 Cooling Pond Blowdown Discharge Structure

The cooling pond blowdown discharge structure shown in Figure 3.4-9 consists of three parallel 30-inch (76-cm) diameter concrete pipes which have an invert elevation of 587 feet msl (179 m) at their outfall. The pipes are positioned at the river bank normal to the river flow, and connect to the 66-inch (168-cm) diameter blowdown line at the edge of the Plant fill as shown in Figure 3.4-9.
9 The system capacity is 220 cfs and the blowdown discharge is regulated by three valves located on each of the 30-inch (76-cm) diameter pipes. This scheme provides control of blowdown discharge velocities up to 15 ft/s (4.6 m/s) by allowing shutoff of one or two of the three pipes depending on the Plant discharge. Thus, by maintaining high discharge momentum when possible, more effective mixing of the blowdown with the river flow is
9 achieved. A concrete apron and riprap in front of the pipe outfalls protect the riverbed from potential erosion due to the jet action.

9

288 345

9

3 The cooling pond blowdown operation is designed to control the pond total dissolved sol.ds (TDS) concentrations which originate from the use of Tittabawassee River water for makeup. TDS contribution from normal Plant
9 operation, such as sulfuric acid and hypochlorite addition to the circulating water are not significant. As evaporation losses of pond water resulting from
3 the heat dissipation process will result in TDS accumulation, the cooling pond blowdown and makeup process will allow for TDS control within the pond operating requirements as demonstrated by a long-term daily simulation of the cooling pond operation(3). The cooling pond blowdown shall comply with
9 Michigan Water Quality Standards regarding temperatures, TDS, and mixing zone size. For a discussion of operation of the blowdown discharge system and the associated thermal effects, refer to Section 5.1.2.

3 The principal parameters influencing the occurrence of cooling pond blowdown and its flowrate are: TDS level in the pond, blowdown temperature, TDS level in the river, river flowrate and ambient river temperature, and the pond water surface elevation. The thermal loading to the river by the discharge of The
9 Dow Chemical Company is incorporated into the physical model study which provides the basis for calculating the maximum allowable blowdown flowrates within the thermal constraints of the river.

3 An automatic control system is provided to minimize the TDS concentration in the cooling pond by maximizing blowdown and makeup flowrates. The frequent

3 changes in the variables, particularly river flow, dictate the need for an automatic rather than a manual system.

9

Pond blowdown is used for radwaste dilution when the blowdown flow is
3 adequate. When the pond blowdown flow is not adequate, the makeup pumps provide the necessary dilution flow and pond blowdown flow is temporarily
7 suspended.

3.4R REFERENCES

1. Alden Research Laboratories, Model Study, Midland Cooling Pond, Consumers Power Company (January 1970), Report prepared for Bechtel Professional Associates Corporation.

2. Bechtel, Incorporated, Cooling Pond Thermal Performance Summary Report;
7 Midland Plant Units 1 and 2 (August 1973), Report prepared for Consumers Power Company.

3. Bechtel Associates Professional Corporation, Final Report - Midland Power
9 Plant - Cooling Pond Operation Study (March 1979), Report prepared for Consumers Power Company.

288 348

2 in Sections 3.4.5 and 5.1.2. The effluent limitations are discussed in
Section 5.1.1.

..e expected cooling pond makeup water quality is given in Table 3.6-3. Evaporative losses of the cooling pond increase the concentration of constituents contained in the cooling water. The concentrations are maintained at a level compatible with Plant operation by discharging and making up a portion of the circulating water. Expected average and maximum cooling pond blowdown volume and characteristics are given in Table 3.6-4. Also given in this table are the expected average and maximum volume and characteristics of the combined Plant discharge to the Tittabawassee River.

As given in Table 3.6-4 and discussed in Section 5.1, the chemical
characteristics of the Plant blowdown are within the discharge limits
2 established in 40 CFR 423. The worst case values given in Table 3.6-4 are
based on conditions whereby the chemicals in the cooling pond are concentrated
7 after historic periods of low river flow(1), resulting in a low operating pond
elevation. Therefore, the major concern is to limit the TDS concentration of
the river below the discharge point to the limits specified in Section 5.1.1.
To control TDS within the State limits, the conductivity of both the ambient
2 river and pond water are measured with permanent instrumentation. The
blowdown piping has flow measurement and control valves that can limit the
blowdown rate to any desired level. The piping arrangement is discussed in
Section 3.4.5.

7 During periods of low pond levels, such as historic periods of low river flow,
the blowdown will be minimal or zero until river conditions allow the pond to
be refilled using the makeup system and blowdown reestablished. In order to

2 maintain Plant operation during dry periods, the pond was sized to permit
normal operation during a 100-day drought without makeup or blowdown. During
those periods in which the pond cannot be blown down, it is anticipated that
the remaining discharges to the river will still be permitted most of the
time. During periods of extremely high river TDS, some of the other Plant
9 discharges may have to be restricted. Provisions have been made to discharge
the turbine building neutralizing sump and the evaporator building
neutralizing wastes to the cooling pond during these periods. The laundry
waste and the oily waste system effluents are low TDS and are always
discharged to the river.

3.6.4.1 Sulfuric Acid Addition to the Circulating Water

Sulfuric acid is added to the circulating water to prevent carbonate scale
deposition on the condenser tube walls by reducing the natural alkalinity
9 (refer to Table 3.6-6).

3.6.4.2 Sodium Hypochlorite Injection

Slime growth on the condenser tube walls is prevented by injecting a sodium
2 hypochlorite solution into each condenser inlet water box for approximately 30
minutes. It is expected that two such injections will be required daily.

288 350

TABLE 3.6-4

EXPECTED CHEMICAL CHARACTERISTICS OF
COOLING POND BLOWDOWN AND COMBINED PLANT DISCHARGE

	Parameter	Pond Blowdown[(a)] Average/Maximum (Node 7 Figure 3.3-1)	Combined Plant Discharge[(a)] Average/Maximum[(c)] (Node 60 Figure 3.3-1)
8	Daily Flow, million gal	11.7/142	11.8/142
1	pH	6.5-9.5	6.5-9.5
8	TDS, mg/l	880/2,200	900/2,500
	TSS, mg/l	<100	<100
	Ca, mg/l	150/540	150/520
	Mg, mg/l	40/130	40/120
	Na, mg/l	60/210	70/270
8	SO_4, mg/l	120/150	140/660
	Cl, mg/l	130/410	130/400
	PO_4[(b)], mg/l	0.18/0.84	0.18/0.81
	Total Residual Chlorine, mg/l	<<0.2/<<0.3	<<0.2/<<0.3
9	Zn[(b)], mg/l	0.05/0.22	0.05/0.22
8	NH_3, mg/l	0.20/1.50	1.67/20.4
	Oil and Grease, mg/l	<15/<20	<15/<20

1 gallon = 3.79 liters

(a) Values given for cooling pond blowdown result from eva[illegible]ve concentration of the makeup water withdrawn from the Tittabawassee River. Chlorina[illegible] of water systems and cooling pond acid treatment are anticipated to increase the val[illegible]s given as follows:

9 Na, 5 mg/l avg - 15 mg/l max
Cl, 8 mg/l avg - 22 mg/l max
SO_4, 200 mg/l avg - 1100 mg/l max

7 Assuming the cooling pond blowdown will be terminated, and the waste streams identified in Items 1 and 2 of Table 3.6-2 will be routed to the cooling pond when discharge to the Tittabawassee River would cause the river to exceed permit limitations, then the following increases in chemical concentrations are expected in the cooling pond:

	Parameter	Max Increase
8	TDS, mg/l	70
	Na, mg/l	15
	SO_4, mg/l	40
	NH_3, mg/l	4

(b) These parameters have been detected in the cooling pond makeup water supply (refer to Table 3.6-3). The values given in the present Table represent evaporative concentration of the makeup water supply values.

8 (c) Maximum concentrations were computed using the minimum blowdown flow (5 cfs) and the maximum instantaneous waste discharge rates.

TABLE 3.6-5

PROCESS STEAM SYSTEM
BLOWDOWN VOLUME AND QUALITY

Daily Volume, gal	115,000 max
TDS, mg/l	1,750 max
TSS, mg/l	150 max
pH	9.5-10.5
SO_3 mg/l	20-30
PO_4 mg/l	30-70

3.6R REFERENCES

1. Bechtel Associates Professional Corporation, Final Report - Midland Power
9 Plant - Cooling Pond Operation Study (March 1979), Report prepared for
Consumers Power Company.

288 ~~348~~ 353

the Soil Erosion and Sedimentation Control Act 347. None of the rivers in the project area are listed under the Michigan Natural Rivers Act 231.

Notification and approval are required from the Tri-City Joint Airport Zoning
9 Board. Tri-City Airport is over 5 miles (8.05 km) from the nearest project transmission line.

There is no known zoning ordinance in conflict with construction plans.

1

3.9.3 Land Usage

The Midland project area is part of the Saginaw Glacial Lake Plain. The terrain is very flat with alluvial clays and fine sandy soils. The Tittabawassee River flows southeast through Midland to join the Shiawassee/Saginaw River south of Saginaw (see Figures 3.9-1, 3.9-2 and 3.9-3A). The Bad River (North and South Branch), Potato, Beaver, Wolf and Swan Creeks and numerous drains converge on the Shiawassee River near St Charles (see Figures 3.9-3C, 3.9-3F and 3.9-3G).

The small villages of Brant, Nelson, Hemlock and Mapleton are the only communities other than Midland that are within one mile (1.61 km) of the transmission lines. Land usage is predominantly agricultural with most farms at least 80 to 160 acres (32 to 65 ha) in size. The dominant crops are corn and navy beans. The area south of Midland is intensively cultivated and nearly treeless. Brant Township in Saginaw County is intersected by a number of creeks and rivers and associated wetlands with a large percentage of early successional stage vegetation (8,9). The Gratiot-Saginaw State Game Area is located west of Brant Township. The Shiawassee River State Game Area is located east of Brant and Fremont Townships. Both game areas are shown on Figure 3.9-1. The only other recreational facilities in the area are the Brant Rifle and Pistol Club in the NE 1/4 of Section 10, Brant Township, Saginaw County and the Maple Hill Golf Course 3 miles (4.83 km) east of Hemlock in the NE 1/4, Section 25, Richland Township, Saginaw County. Fraser Airport and Sonefield Agency Airport, shown on Figure 3.9-1, are the two airfields nearest to Plant project transmission facilities.

3.9.4 Environmental Assessment

3.9.4.1 Terminal Points

The two 345 kV bus tie lines between the Midland Plant Units and Tittabawassee Substation terminate on the south turbine building wall. The two 138 kV start-up lines terminate on independent steel structures located east of the turbine building.

All Plant-related transmission lines terminate at the existing Tittabawassee Substation located 1.4 miles (2.25 km) east-southeast of the Midland Plant. The apparent size of the 14-acre (5.67-ha) low-profile substation is reduced by a setback of approximately 1,250 feet (381 m) east from Waldo Road and 500 feet (152.4 m) south from Milner Road (see Figure 3.9-4). The setback also effectively attenuates any equipment generated noise. Vehicles associated with maintenance and inspection of the substation are parked onsite away from public roads. This 80-acre (32.4-ha) substation site is adjacent to

288 358

4.2 TRANSMISSION FACILITIES CONSTRUCTION

Transmission lines associated with the Midland Nuclear Plant construction consist of two 345 kV lines running 2.3 miles (3.7 km) to Tittabawassee Substation and one 345 kV line running 27.5 miles (44.2 km) from Tittabawassee Substation to interconnect with the existing Kenowa-Thetford 345 kV line. The line route between the Plant and the substation crosses flat land identified as industrial or wasteland. The 27.5-mile (44.2 km) section of line running south out of the substation crosses farmlands mixed with occasional woodlots.

Another line associated with the project is a 138 kV start-up line running south along the east side of the cooling pond and east along the north side of Gordonville Road. This line crosses the Tittabawassee River and Saginaw Road approximately 1 mile (1.6 km) south of the 345 kV line crossings and then continues northeast into Tittabawassee Substation. The clearing at the river is for construction access with a majority of the right-of-way selectively cleared to preserve low growing species. There is an ample amount of roadside trees along Saginaw Road to obstruct views to the line at the crossing location.

Routing of the 138 kV start-up line and the two 345 kV lines judiciously utilizes existing vegetation. An insignificant amount of clearing is required between the Midland Plant and Tittabawassee Substation. The Tittabawassee to Kenowa-Thetford 345 kV line requires clearing only 110.9 acres (45 ha) of scattered fencerows and woodlots at a width of 142 feet (43.3 m). Additional trees outside the cleared right-of-way which endanger the line are selectively removed.

288 356

The most visually sensitive area affected by new transmission lines is the northern one-third of the Tittabawassee to Kenowa-Thetford right-of-way[1]. In this area, the flat terrain is nearly lacking of arborescent vegetation. Agriculture in this area is practiced up to roadsides and ditch banks. The predominance of row crops also has eliminated fencerows and the vegetation that usually is present along fencerows. Although the transmission towers are exposed for long distances, the rural nature of the surrounding area reduces the effects of this exposure.

The remaining portion of the Tittabawassee to Kenowa-Thetford 345 kV line route has a moderate sensitivity. In some areas the line will be screened by existing woodlots and stream valleys.

Design, routing, construction and maintenance of these transmission lines is done in accordance with Environmental Criteria for Electric Transmission Systems[2] developed by the US Departments of Interior and Agriculture, and Guidelines for the Protection of Natural, Historic, Scenic and Recreational Values in the Design and Location of Rights-of-Way and Transmission Facilities[3] published by the Federal Power Commission. In addition, the Applicant has engaged landscape architects to develop guidelines[4] for minimizing impact of transmission lines and facilities on aesthetic values. These criteria have been applied in design of the transmission lines from the Midland Plant to the substation, and from the substation to the Kenowa-Thetford line.

9 | Approval of the Corps of Engineers will be obtained approximately 30 days prior to construction for erecting the transmission lines across the Tittabawassee River.

CHAPTER 5

TABLE OF CONTENTS

288 358

f. Prevent any discharge which would result in increasing the phosphorus concentration in the river above 0.05 ppm (see Section V, Pages 18 and 20).

g. In order to assure that the chlorine residual in the river is negligible, the concentration in the pond blowdown must be limited to 0.05 ppm (see Section V, Page 18, and Section V, Page 20).

Only four of the seven license conditions (requirements 7(a), (b), (c) and (d)) were incorporated in the construction Permits No CPPR-81 and CPPR-82 issued December 15, 1972 by the Atomic Energy Commission (AEC)[2]. The remaining three license conditions (7(e), (f) and (g)) relate to operation of the facility.

5.1.1.3.1 Chlorine

Recommendations 7(e) and (g) are directly related to each other as the biocide considered for control of nuisance algae in the pond is chlorine. Federal effluent guidelines for free available chlorine are published in 40 CFR, Section 423.12. These guidelines limit the maximum free available chlorine concentration discharged to 0.5 mg/l and the average free available chlorine concentration to 0.2 mg/l.

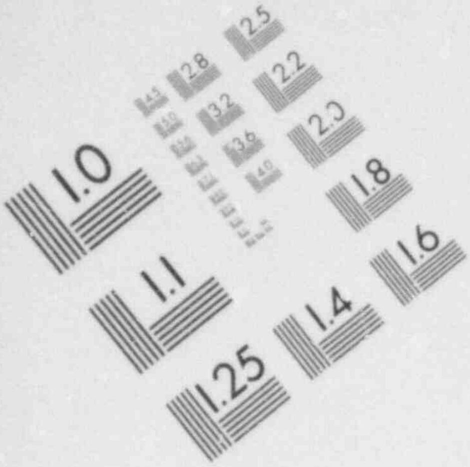
The MWRC Rules contain no chlorine standards or limitations. Rather, Rule 323.1082 establishes "a mixing zone to achieve a mixture of a point source discharge with the receiving waters . . ." This Rule also provides "as a minimum restriction the toxic substance 96 hour TL_m for important species of fish or fishfood organisms shall not be exceeded in the mixing zone at any point inhabitable by these organisms, unless it can be demonstrated to the MWRC that a higher concentration is acceptable."

288 360

Under the guidance offered by Rule 323.1082, the MWRC had adopted the policy,
8 in State-issued NPDES Permits, of limiting the intermittent discharge of total
residual chlorine from steam electric plants to 0.5 mg/l through June 30, 1977
and to 0.20 mg/l and 0.04 mg/l (dependent upon water temperature) after
July 1, 1977. However, the MWRC has provided dischargers the opportunity to
demonstrate that chlorine concentrations higher than the July 1, 1977 limits
are acceptable. On January 13, 1977, Consumers Power Company submitted a
chlorine demonstration study[3] to the MWRC for all of its generating plants.
As a result of this demonstration study, the MWRC in 1978 established new
8 chlorine limits for Company facilities. The Company believes these new limits
are sufficient to allow effective condenser cleaning without the need to
dechlorinate or make other operational changes, however, the Company is
9 permitted to use certain dechlorination techniques to achieve the applicable
limits.

8 The new limits restrict the discharge of total residual chlorine to receiving
waters to 0.20 mg/l as a daily average computed on a monthly basis and to 0.30
9 mg/l as a maximum at existing steam-electric plants when chlorine application
time does not exceed 160 minutes in any 24-hour period. Associated with these
new limits has been an additional requirement that the Company conduct a year-
8 long study of the percentage of free chlorine discharged [illegible] eceiving
waters at each of its existing steam-electric plants. [illegible] tion of this
study, these limits will either be retained or modified b[illegible] MWRC.

It is expected that the chlorine concentration in the cooling pond blowdown
8 from the Midland Plant will be within these revised limits. If necessary, the
pond blowdown will be suspended, as suggested in Recommendation 7(e), until
the biocide (chlorine) degrades to acceptable discharge levels.



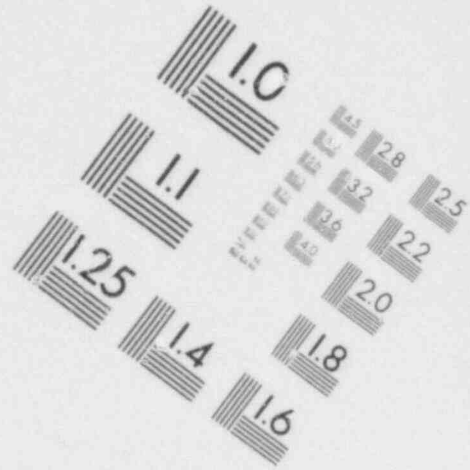
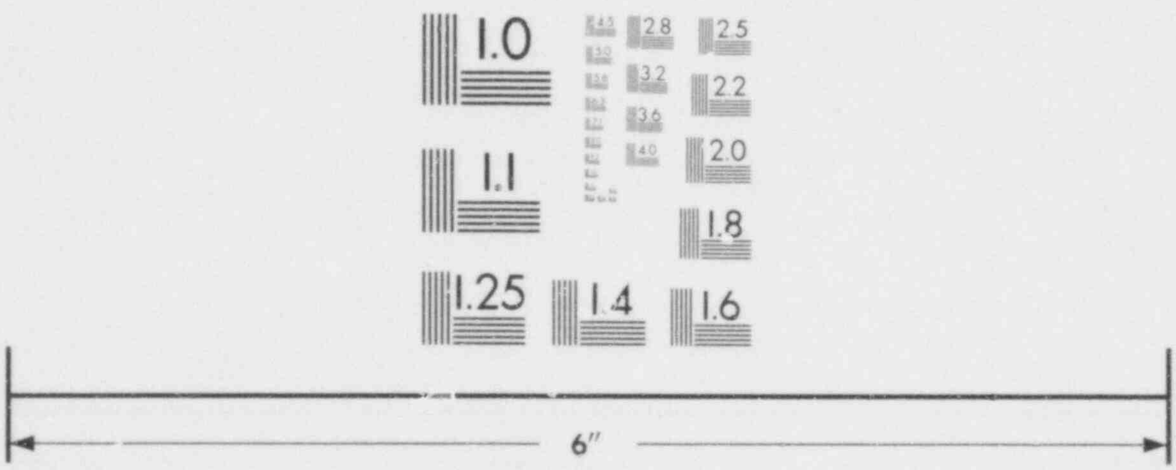
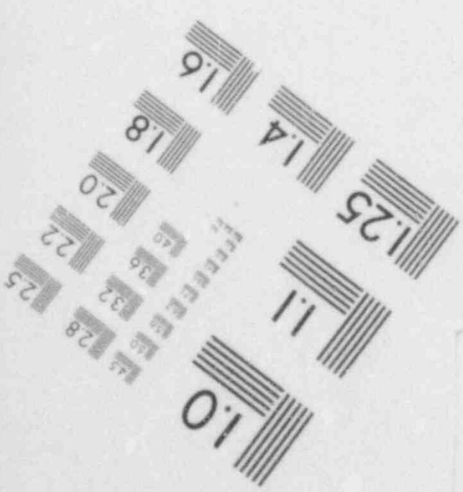
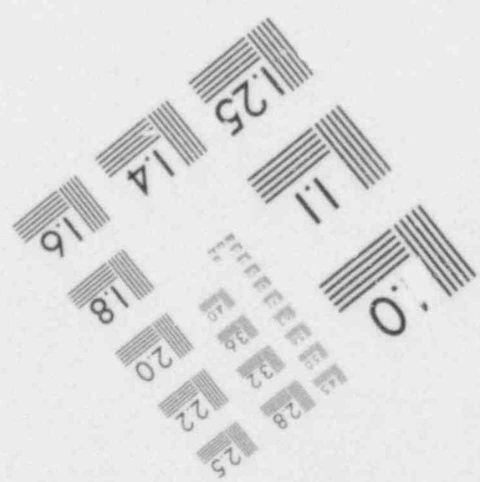
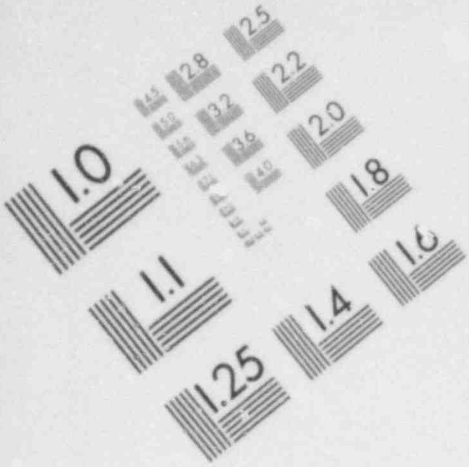


IMAGE EVALUATION TEST TARGET (MT-3)









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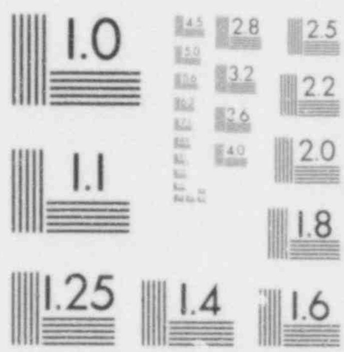

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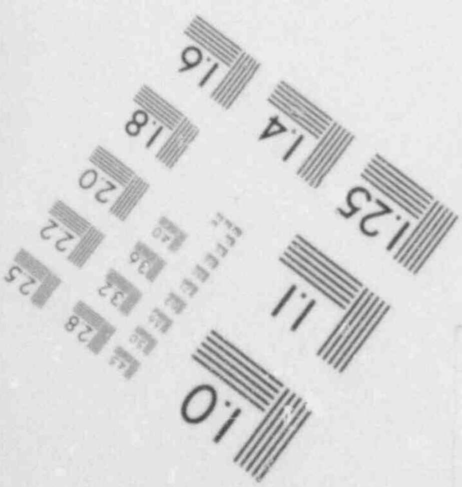
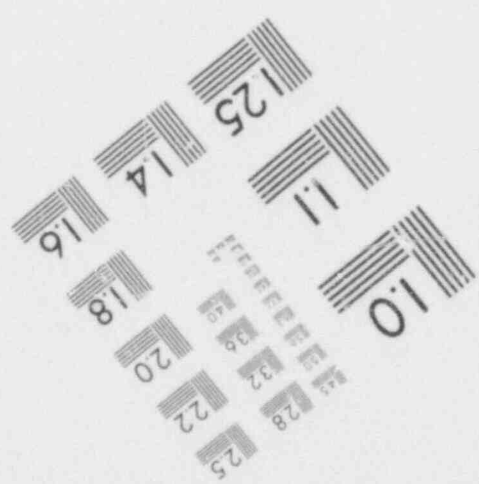
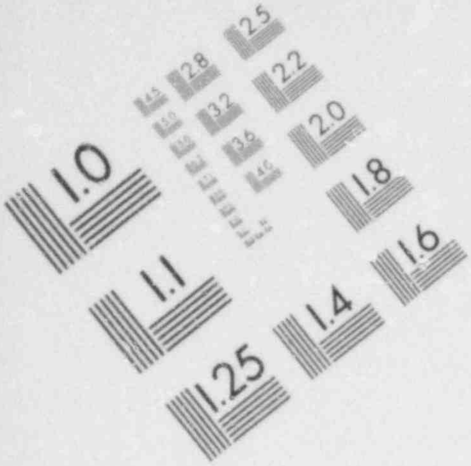






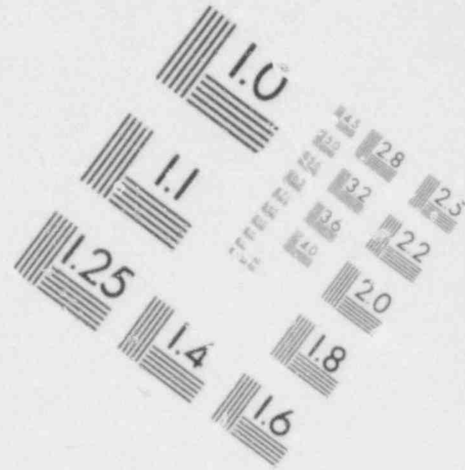
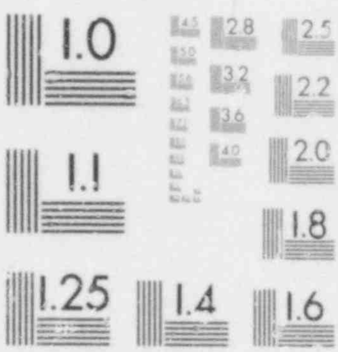


IMAGE EVALUATION TEST TARGET (MT-3)



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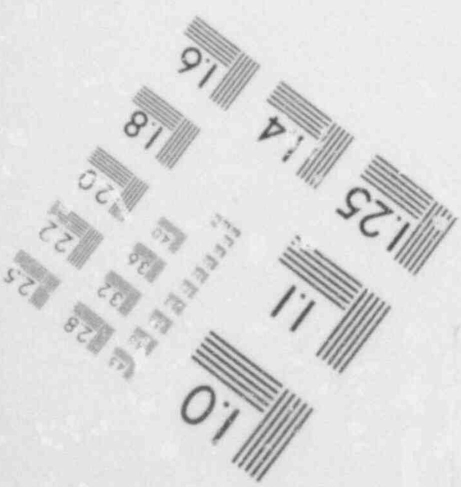

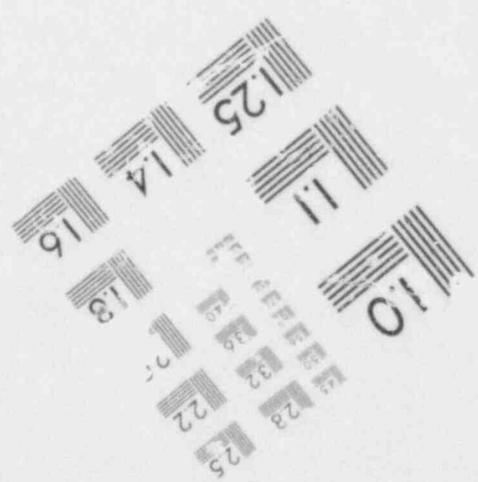

40 CFR, Section 423.13. These guidelines establish a daily maximum phosphorus concentration of 5.0 mg/l and a monthly average concentration of 5.0 mg/l.

MWRC Rule 323.1060 addresses plant nutrients. The Rule states in part: "Phosphorus which is or may readily become available as a plant nutrient shall be controlled from point source discharges by the application of methods utilizing best practicable waste treatment technology for control of total phosphorus, with the goal of achieving a monthly average effluent concentration of 1 milligram per liter as P."

5.1.2 Physical Effects

Cooling pond blowdown is discharged at the south bank of the Tittabawassee River. The blowdown enters the river as a 30-inch (76-cm) diameter jet (or jets) perpendicular to the river and rapidly mixes with river water through a jet entrainment process. The Dow Chemical Company also discharges its
3 effluent at the south river bank. The Dow Chemical Company discharge is about 300 feet (91 m) upstream from the Plant blowdown discharge structure as shown in Figure 5.1B-1. A thermal plume is formed by these two discharges along the south bank of the Tittabawassee River. Field observation of The Dow Chemical
7 Company discharge and physical model testing results indicate that both The Dow Chemical Company's tertiary pond discharge and the Plant blowdown achieve full vertical mixing with river water. Thus the plume is only two dimensional
3 with equal temperature throughout the river depth.

A physical model is used to determine a set of maximum allowable blowdown flowrates over ranges of blowdown excess temperatures (temperature of the
7 effluent less ambient natural river temperature) and river flows so that the

287 001

7 size of the resulting thermal plume is within State of Michigan Water Quality
Standards[5]. Details of the physical model and test programs are described
in Appendix 5.1B-1 and in the final report of the physical model study[17] and
in the final cooling pond operation study[18]. The independent variables used
9 in the physical model test program are: river discharge, Plant makeup
flowrate, plant blowdown (blowdown temperature less ambient river temperature)
excess temperature; total dissolved solids concentration, flowrate, and excess
temperature of The Dow Chemical Company effluent. Values of these variables
and the maximum allowable blowdown flowrates obtained from the model tests are
listed in Table 5.1-1. The isotherms for the worst case of each of the river
flows tested are shown in Figure 5.1-1 through Figure 5.1-5. In all cases,
thermal plumes defined by the 5°F (2.8°C) isotherm will not contain more than
25% of the river cross-sectional area or volume of river flow at any transect
on an average temperature basis which is in accordance with the State of
3 Michigan Water Quality Standards[5] and the thermal plume lengths are limited
to 1,700 feet (515 m).

During normal Plant operation, because of frequent changes in some of the
independent variables, especially the river flow, an automatic control system
is used to measure the independent variables, to calculate the blowdown
flowrate, and to set the valve openings for the calculated blowdown flow. The
9 cooling pond blowdown shall comply with Michigan Water Quality Standards
3 regarding temperatures, TDS, mixing zone length, and width. The cooling pond
is generally kept full when possible and therefore blowdown may be voluntarily
9 restricted when makeup cannot keep up with pond water losses caused by
evaporation and seepage. The operation of the cooling pond is simulated on a
daily basis over an 82-year period. The physical model test results together

28/ 002

9 with the following restrictions on the timing and the flowrate of blowdown were used in the simulation:

3 a. Set blowdown flowrate to zero if the measured natural river temperature exceeds the allowable monthly maximum temperatures.

9 b. After full mixing, at Freeland Bridge, the combined contribution of
3 TDS from both the Plant blowdown and The Dow Chemical Company effluent shall not cause the river TDS concentration to exceed 500 ppm.

c. When discharging, blowdown flowrate should be within the range from
9 5 cfs to 220 cfs.

The simulation results indicate that the blowdown discharge is most likely to
3 be continuous during March, April and May. For the remaining months, the blowdown discharge may be intermittent. During periods of blowdown, the
9 thermal plume will not be longer than 1700 feet (515 m) and will comply with the 25% river cross-sectional area or volume of flow limits of the Water Quality Standards on an average temperature basis.

5.1.3 Biological Effects

During the operation of the Midland Plant, the removal of heat will be accomplished by a closed-cycle system incorporating an 880-acre (356-ha) cooling pond containing 12,600 acre-feet of water. The heat is dissipated from the cooling pond to the atmosphere by radiation, evaporation and convection.

Assessment of the impact of Plant operation on the aquatic system is based on the conceptual design of the circulating water system and condenser design characteristics (refer to Section 3.4) and the biological analyses of the Tittabawassee River presented in Section 2.2. During Plant operation the impact on aquatic life occurs during the makeup or blowdown phases. Makeup water pumping is limited by the flowrate of the Tittabawassee River (refer to

289 004

Laboratory for Water Resources and Hydrodynamics, MIT, Cambridge, Massachusetts, p 439.

15. H G Houghton and W H Radford, "On the Measurement of Drop Size and Liquid Content in Fogs and Clouds," MIT Papers, Physical Oceanography and Meteorology, 6, No 4 (1938), p 31.

16. Murray and Trettel, Inc, Report on Meteorological Aspects of Operating the Cooling Lake and Sprays at Dresden Nuclear Power Station, (1973), Report prepared for Commonwealth Edison Company, p 81.

17. Alden Research Laboratories, Investigation of a Thermal Plume in a Shallow River - Hydrothermal Model Studies - Cooling Pond Blowdown Discharge - Midland Nuclear Power Station (April 1979), Research
9 sponsored by Bechtel Power Corporation for Consumers Power Company.

18. Bechtel Associates Professional Corporation, Final Report - Midland Power Plant - Cooling Pond Operation Study (March 1979), Report prepared for Consumers Power Company.

289 005

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1. Alden Research Laboratories, Investigation of a Thermal Plume in a Shallow
9 River - Hydrothermal Model Studies - Cooling Pond Blowdown Discharge -
Midland Nuclear Power Station (April 1979), Research sponsored by Bechtel
Power Corporation for Consumers Power Company.

2. N Yotsukura and E D Cobb, Transverse Diffusion of Solutes in Natural Streams, Professional Paper 582-C (1972), US Geological Survey.

3. Directorate of Regulatory Standards, Estimating Aquatic Dispersion of Effluents From Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, Regulatory Guide 1.113 (May 1976), US Nuclear Regulatory Commission.

4. J W Elder, "The Dispersion of Marked Fluid in Turbulent Shear Flow." Journal of Fluid Mechanics, No 5, pp 544-560, 1959.

5. N Yotsukura and W W Sayre, "Transverse Mixing in Natural Channels," Water Resources Research, Vol 12, No 4, August 1976.

6. US Geological Survey, "Discharge Measurements at Gaging Stations," Techniques of Water Resources Investigations of the USGS, Chapter A8, 1969.

TABLE 5.2-13

LIQUID EFFLUENT CONCENTRATIONS[(a)]
(μCi/cc)

	Radionuclide	Diluted by Cooling Pond Blowdown	10 CFR 20 Table II, Col 2	Fraction of 10 CFR 20
	Br-83	1.42E-13	3.0E-6	4.7E-8
	I-130	2.84E-13	3.0E-6	9.5E-8
	I-131	8.02E-11	3.0E-7	2.7E-4
	I-132	2.76E-12	8.0E-6	3.5E-7
	I-133	5.60E-11	1.0E-6	5.6E-5
	I-134	4.79E-13	2.0E-5	2.4E-8
	I-135	1.29E-11	4.0E-6	3.2E-6
	Rb-86	4.30E-14	7.0E-5	6.1E-10
	Cs-134	3.57E-10	9.0E-6	4.0E-5
	Cs-136	5.62E-12	9.0E-5	6.2E-8
	Cs-137	6.38E-10	2.0E-5	3.2E-5
	Cr-51	3.49E-13	2.0E-3	1.8E-10
	Mn-54	2.60E-11	1.0E-4	2.6E-7
	Fe-55	3.23E-13	8.0E-4	4.1E-10
	Fe-59	1.96E-13	6.0E-5	3.3E-9
	Co-58	1.07E-10	1.0E-4	1.1E-6
	Co-60	2.35E-10	5.0E-5	4.7E-6
	Sr-89	7.79E-14	3.0E-6	2.6E-8
	Sr-90	2.01E-15	3.0E-7	6.7E-9
	Sr-91	8.10E-14	7.0E-5	1.2E-9
	Y-91	3.57E-13	3.0E-5	1.2E-8
	Y-93	1.64E-14	3.0E-5	5.5E-10
	Zr-95	3.65E-11	6.0E-5	6.1E-7
	Nb-95	5.21E-11	1.0E-4	5.2E-7
	Mo-99	6.75E-11	2.0E-4	3.4E-7
1	Ru-103	3.65E-12	8.0E-5	4.6E-8
	Ru-106	6.25E-11	1.0E-5	6.3E-6
	Te-125m	4.09E-15	2.0E-4	2.1E-11
	Te-127m	4.12E-14	6.0E-5	6.9E-10
	Te-129m	2.73E-13	3.0E-5	9.1E-9
	Te-131m	1.58E-13	6.0E-5	2.6E-9
	Te-132	3.46E-12	3.0E-5	1.2E-7
	Ba-140	3.78E-14	3.0E-5	1.3E-9
	Ce-141	1.18E-14	9.0E-5	1.3E-10
	Ce-143	6.30E-15	4.0E-5	1.6E-10
	Ce-144	1.30E-10	1.0E-5	1.3E-5
	Pr-143	7.60E-15	5.0E-5	1.5E-10
	Np-239	2.00E-13	1.0E-4	2.0E-9
	Ag-110m	1.15E-11	3.0E-5	3.8E-7
	H-3	6.07E-6	3.0E-3	2.0E-3
			TOTAL	2.5E-3

1 (a) Based on a Plant discharge flowrate of 43 cfs, which is the average of the estimated monthly average Plant discharge flowrates given in Table 5.2-14.

TABLE 5.2-14

MONTHLY PLANT DISCHARGE AND
CONCENTRATIONS OF IMPORTANT RADIONUCLIDES

			Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
	Plant Discharge Flow for Near Field Computations (cfs)		47.6	47.6	60	88	62	47.6	47.6	47.6	47.6	47.6	47.6	47.6
9	Radionuclide Concentrations in Plant Discharge (μCi/cc)	H-3	5.5E-06	5.5E-06	4.3E-06	3.0E-06	4.2E-06	5.5E-06	5.5E-06	5.5E-06	5.5E-06	5.5E-06	5.5E-06	5.5E-06
		I-131	7.3E-11	7.3E-11	5.7E-11	3.9E-11	5.6E-11	7.3E-11	7.3E-11	7.3E-11	7.3E-11	7.3E-11	7.3E-11	7.3E-11
		Cs-134	3.1E-10	3.1E-10	2.5E-10	1.7E-10	2.4E-10	3.1E-10	3.1E-10	3.1E-10	3.1E-10	3.1E-10	3.1E-10	3.1E-10
		Cs-137	5.8E-10	5.8E-10	4.6E-10	3.1E-10	4.4E-10	5.8E-10	5.8E-10	5.8E-10	5.8E-10	5.8E-10	5.8E-10	5.8E-10

TABLE 5.2-15

AVERAGE MONTHLY AND YEARLY DILUTION FACTORS AND TRAVEL TIMES IN TITTABAWASSEE RIVER, SAGINAW RIVER AND SAGINAW BAY

9 Dilution Factors[c]

Location[a]	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
9 1	3	3	5	4	3	3	2	2	2	2	3	3	3
2	8	9	20	19	11	7	5	4	5	5	7	7	9
3	9	10	23	23	13	9	6	5	6	6	8	8	11
4	14	16	37	36	21	14	9	8	9	9	13	13	17
5	15	17	38	37	22	14	10	8	9	9	13	14	17
6	60	69	154	150	89	58	39	32	37	37	53	56	70
7	90	104	230	224	134	86	58	47	56	56	79	84	104
8	270	311	691	673	401	259	175	142	167	167	238	252	312

Travel Times (Hours)

Location[a]	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1	0	0	0	0	0	0	0	0	0	0	0	0	0
2	13	12	10	10	11	14	19	23	20	18	15	14	15
3	26	23	14	14	19	26	41	53	44	39	29	27	30
4	64	55	28	28	43	64	108	141	115	100	72	68	74
5	72	61	31	31	48	72	121	158	129	112	81	76	83
6	(b)	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-	-

(a) See Figure 5.2-11 for location identification.

(b) Not available.

9 (c) Dilution factors have been rounded to nearest integer.

TABLE 5.2-16

MONTHLY RADIONUCLIDE CONCENTRATIONS
(μ Ci/cc)

Location #	Radionuclide	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1	H-3	.18E-05	.18E-05	.72E-06	.60E-06	.14E-05	.18E-05	.27E-05	.27E-05	.27E-05	.27E-05	.18E-05	.18E-05
	I-131	.24E-10	.24E-10	.95E-11	.78E-11	.19E-10	.24E-10	.37E-10	.37E-10	.37E-10	.37E-10	.24E-10	.24E-10
	Cs-134	.10E-09	.10E-09	.42E-10	.34E-10	.80E-10	.10E-09	.16E-09	.16E-09	.16E-09	.16E-09	.10E-09	.10E-09
	Cs-137	.19E-09	.19E-09	.77E-10	.62E-10	.15E-09	.19E-09	.29E-09	.29E-09	.29E-09	.29E-09	.19E-09	.19E-09
2	H-3	.69E-06	.61E-06	.22E-06	.16E-06	.38E-06	.79E-06	.11E-05	.14E-05	.11E-05	.11E-05	.79E-06	.79E-06
	I-131	.91E-11	.81E-11	.28E-11	.21E-11	.51E-11	.10E-10	.15E-10	.18E-10	.15E-10	.15E-10	.10E-10	.10E-10
	Cs-134	.39E-10	.34E-10	.12E-10	.89E-11	.22E-10	.44E-10	.62E-10	.78E-10	.62E-10	.62E-10	.44E-10	.44E-10
	Cs-137	.72E-10	.64E-10	.23E-10	.16E-10	.40E-10	.83E-10	.12E-09	.14E-09	.12E-09	.12E-09	.83E-10	.83E-10
3	H-3	.61E-06	.55E-06	.19E-[illegible]	.13E-06	.32E-06	.61E-06	.92E-06	.11E-05	.92E-06	.92E-06	.69E-06	.69E-06
	I-131	.81E-11	.73E-11	.25E-11	.17E-11	.43E-11	.81E-11	.12E-10	.15E-10	.12E-10	.12E-10	.91E-11	.51E-11
	Cs-134	.34E-10	.31E-10	.11E-10	.74E-11	.18E-10	.34E-10	.52E-10	.62E-10	.52E-10	.52E-10	.39E-10	.39E-10
	Cs-137	.64E-10	.58E-10	.20E-10	.13E-10	.34E-10	.64E-10	.97E-10	.12E-09	.97E-10	.97E-10	.72E-10	.72E-10
4	H-3	.39E-06	.34E-06	.12E-06	.83E-07	.20E-06	.39E-06	.61E-06	.69E-06	.61E-06	.61E-06	.42E-06	.42E-06
	I-131	.52E-11	.46E-11	.15E-11	.11E-11	.27E-11	.52E-11	.81E-11	.91E-11	.81E-11	.81E-11	.56E-11	.56E-11
	Cs-134	.22E-10	.19E-10	.68E-11	.47E-11	.11E-10	.22E-10	.34E-10	.39E-10	.34E-10	.34E-10	.24E-10	.24E-10
9	Cs-137	.41E-10	.36E-10	.12E-10	.86E-11	.21E-10	.41E-10	.64E-10	.72E-10	.64E-10	.64E-10	.45E-10	.45E-10
5	H-3	.37E-06	.32E-06	.11E-06	.81E-07	.19E-06	.39E-06	.55E-06	.69E-06	.61E-06	.61E-06	.42E-06	.39E-06
	I-131	.49E-11	.43E-11	.15E-11	.11E-11	.25E-11	.52E-11	.73E-11	.91E-11	.81E-11	.81E-11	.56E-11	.52E-11
	Cs-134	.21E-10	.18E-10	.66E-11	.46E-11	.11E-10	.22E-10	.31E-10	.39E-10	.34E-10	.34E-10	.24E-10	.22E-10
	Cs-137	.39E-10	.34E-10	.12E-10	.84E-11	.20E-10	.41E-10	.58E-10	.72E-10	.64E-10	.64E-10	.45E-10	.41E-10
6	H-3	.92E-07	.80E-07	.28E-07	.20E-07	.47E-07	.95E-07	.14E-06	.17E-06	.15E-06	.15E-06	.10E-06	.98E-07
	I-131	.12E-11	.11E-11	.37E-12	.26E-12	.63E-12	.13E-11	.19E-11	.23E-11	.20E-11	.20E-11	.14E-11	.13E-11
	Cs-134	.52E-11	.45E-11	.16E-11	.11E-11	.27E-11	.53E-11	.79E-11	.97E-11	84E-11	.84E-11	.58E-11	.55E-11
	Cs-137	.97E-11	.84E-11	.30E-11	.21E-11	.49E-11	.10E-10	.15E-10	.18E-10	.16E-10	.16E-10	.11E-10	.10E-10
7	H-3	.61E-07	.53E-07	.19E-07	.13E-07	.31E-07	.64E-07	.95E-07	.12E-06	.98E-07	.98E-07	.70E-07	.65E-07
	I-131	.81E-12	.70E-12	.25E-12	.17E-12	.42E-12	.85E-12	.13E-11	.16E-11	.13E-11	.13E-11	.92E-12	.87E-12
	Cs-134	.34E-11	.30E-11	.11E-11	.76E-12	.18E-11	.36E-11	.53E-11	.66E-11	.55E-11	.55E-11	.39E-11	.37E-11
	Cs-137	.64E-11	.56E-11	.20E-11	.14E-11	.33E-11	.67E-11	.10E-10	.12E-10	.10E-10	.10E-10	.73E-11	.69E-11
8	H-3	.20E-07	.18E-07	.62E-08	.45E-08	.10E-07	.21E-07	.31E-07	.39E-07	.33E-07	.33E-07	.23E-07	.22E-07
	I-131	.27E-12	.23E-12	.82E-13	.58E-13	.14E-12	.28E-12	.42E-12	.51E-12	.44E-12	.44E-12	.31E-12	.28E-12
	Cs-134	.11E-11	.10E-11	.36E-12	.25E-12	.60E-12	.12E-11	.18E-11	.22E-11	.19E-11	.19E-11	.13E-11	.12E-11
	Cs-137	.21E-11	.19E-11	.67E-12	.46E-12	.11E-11	.22E-11	.33E-11	.41E-11	.35E-11	.35E-11	.24E-11	.23E-11

289 010

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289 012

TABLE 5.3-1

AMBIENT CONCENTRATIONS AND CALCULATED INCREASES IN PRIMARY CHEMICAL CONSTITUENTS (mg/l) IN THE TITTABAWASSEE RIVER AT THE MIDLAND PLANT AT VARIOUS PLANT OPERATING AND RIVER CONDITIONS

COOLING POND BLOWDOWN
(Average Concentrations)

Q[a] (Cfs)	Q_b[a] (Cfs)	ΔT[a] (°F)	Dilution[b] Factor	TDS	Ca	Mg	Na	SO_4	Cl	PO_4	NH_3
			0[c]	880	150	40	60(65)[d]	120(320)[e]	130(138)[f]	0.16	0.20
835	13.1	19.4	3.9	226	39	10	15(17)	31(82)	33(35)	0.05	0.05
			4.8	183	31	8	13(14)	25(67)	27(29)	0.04	0.04
			19.4	45	8	2	3(3)	6(16)	7(7)	0.01	0.01
1305	73	12.3	2.5	352	60	16	24(26)	48(127)	52(55)	0.07	0.08
			3.1	284	48	13	19(21)	39(103)	42(45)	0.06	0.07
			12.3	72	12	3	5(5)	10(26)	10(11)	0.01	0.01
2065	73	24.2	4.8	183	31	8	13(14)	25(66)	27(29)	0.04	0.04
			6.0	147	25	7	10(11)	20	22(23)	0.03	0.03
			24.2	36	6	2	2(3)	5(13)	5(6)	0.01	0.01
3015	73	29.7	5.9	149	25	7	10(11)	20(54)	22(23)	0.03	0.03
			7.4	119	20	5	8(9)	16(43)	17(19)	0.02	0.03
			29.7	30	5	1	2(2)	4(11)	4(5)	0.01	0.01
3515	146	17.8	3.6	244	42	11	17(18)	34(89)	36(38)	0.05	0.05
			4.4	200	34	9	14(19)	27(72)	29(31)	0.04	0.05
			17.8	49	8	2	3(4)	7(18)	7(8)	0.01	0.01

COOLING POND BLOWDOWN
(Maximum Concentrations)

Q[a] (Cfs)	Q_b[a] (Cfs)	ΔT[a] (°F)	Dilution[b] Factor	TDS	Ca	Mg	Na	SO_4	Cl	PO_4	NH_3
			0[c]	2200	540	130	210(225)[g]	150(1250)[h]	410(432)[i]	0.84	1.50
835	13.1	19.4	3.9	561	139	32	54(57)	39(318)	105(111)	0.22	0.38
			4.8	456	113	27	44(47)	32(259)	85(90)	0.18	0.32
			19.4	113	28	[illegible]	11(12)	8(64)	21(22)	0.04	0.08
1305	73	12.3	2.5	875	216	52	84(90)	60(497)	164(173)	0.34	0.60
			3.1	706	175	42	68(72)	49(400)	132(140)	0.27	0.49
			12.3	178	44	11	17(18)	12(101)	33(35)	0.07	0.12
2065	73	24.2	4.8	456	113	27	44(47)	32(259)	85(90)	0.18	0.32
			6.0	365	90	22	35(37)	25(207)	68(72)	0.14	0.25
			24.2	90	22	5	9(9)	(51)	17(18)	0.03	0.06
3015	73	29.7	5.9	371	92	22	36(38)	26(210)	70(73)	0.14	0.26
			7.4	296	73	18	28(30)	20(168)	55(59)	0.12	0.20
			29.7	74	18	4	7(8)	5(42)	14(15)	0.03	0.05
3515	146	17.8	3.6	608	150	36	58(62)	42(345)	114(120)	0.24	0.42
			4.4	497	123	30	48(49)	34(282)	93(98)	0.19	0.35
			17.8	123	30	7	12(13)	9(70)	23(24)	0.05	0.08

COMBINED PLANT DISCHARGE
(Average Concentrations)

289 013

			0[c]	900	150	40	70(75)	140(340)[e]	130(138	0.18	1.47
835	13.1	19.4	3.9	231	39	10	18(19)	36(88)	33(35)	0.05	0.43
			4.8	187	31	8	15(16)	29(71)	27(29)	0.04	0.35
			19.4	46	8	2	4(4)	7(18)	7(7)	[illegible].01	0.08
1305	73	12.3	2.5	360	50	16	28(30)	56(137)	52(55)	0.07	0.67
			3.1	290	49	13	23(24)	45(110)	42(45)	0.06	0.54
			12.3	73	12	3	6(6)	11(28)	10(11)	0.01	0.13
2065	73	24.2	4.8	187	31	8	15(16)	29(71)	27(29)	0.04	0.35
			6.0	150	25	7	12(13)	23(57)	22(23)	0.03	0.28
			24.2	37	6	2	3(3)	6(14)	5(6)	0.01	0.07
3015	73	29.7	5.9	152	25	7	12(13)	24(58)	22(23)	0.03	0.28
			7.4	122	20	5	9(10)	19(46)	17(19)	0.02	0.22
			29.7	30	5	1	2(3)	5(12)	4(5)	0.01	0.06
3515	146	17.8	3.6	250	42	11	20(21)	39(95)	36(38)	0.05	0.46
			4.4	204	34	9	16(17)	32(78)	29(31)	0.04	0.38
			17.8	51	8	2	4(4)	8(19)	7(8)	0.01	0.10

COMBINED PLANT DISCHARGE
(Maximum Concentrations)

			0[c]	2500	520	120	270(285)[g]	660(1760)[h]	400(422)[i]	0.81	20.4
835	13.1	19.4	3.9	641	133	31	69(73)	169(450)	103(108)	0.21	5.2
			4.8	521	108	25	56(59)	137(366)	84(88)	0.17	4.3
			19.4	129	27	6	14(15)	34(90)	21(22)	0.04	1.1
1305	73	12.3	2.5	1000	207	48	128(133)	263(702)	161(168)	0.32	8.2
			3.1	806	167	39	87(92)	212(566)	130(136)	0.26	6.6
			12.3	203	42	10	22(23)	54(143)	33(34)	0.06	1.7
2065	73	24.2	4.8	521	108	25	56(59)	137(366)	84(88)	0.17	4.3
			6.0	417	86	20	45(47)	110(293)	67(70)	0.14	3.4
			24.2	103	21	5	11(12)	27(73)	17(17)	0.03	0.9
3015	73	29.7	5.9	424	88	20	46(48)	112(298)	68(71)	0.14	3.5
			7.4	338	70	16	36(39)	89(237)	54(57)	0.11	2.7
			29.7	84	17	[illegible]	[illegible](10)	22(59)	14(14)	0.02	0.7
3515	146	17.8	3.6	694	144	33	75(79)	183(488)	112(117)	0.23	5.6
			4.4	568	118	27	61(65)	150(400)	91(95)	0.19	4.7
			17.8	140	32	7	15(16)	37(99)	23(24)	0.05	1.2
Tittabawassee River Average[j]				390	70	20	30	50	60	0.08	0.09
Ambient Concentrations[j] Maximum				470	110	30	40	100	90	0.18	0.32

(a) Q, Q_b, ΔT defined on Figures 5.1-1 to 5.1-5. Data from these figures were used to calculate isodilution factors $\left(\frac{\Delta T}{\text{isotherm}}\right)$

(b) The dilution factors are conservative because the Dow ΔT = 5°F is included in the thermal data used to calculate dilutions.

(c) Concentrations at the end of the blowdown pipe.

(d) Number between parentheses reflects an increase of an average of 5 mg/l of Na due to chlorination.

(e) Number between parentheses reflects an increase of an average of 200 mg/l of SO_4 due to cooling pond acid treatment.

(f) Number between parentheses reflects an increase of an average of 8 mg/l of Cl due to chlorination.

(g) Number in parentheses reflects an increase of maximum of 15 mg/l of Na due to chlorination.

(h) Number between parentheses reflects an increase of maximum of 1100 mg/l of SO_4 due to cooling pond acid treatment.

(i) Number in parentheses reflects an increase of maximum of 22 mg/l of Cl due to chlorination.

(j) Values taken from Table 3.6-3. Values presented are those expected at the intake structure.

289 014

APPENDIX 6.2A

TABLE OF CONTENTS

7

289 016

APPENDIX 6.2A

LIST OF TABLES

289 017

APPENDIX 6.2A

LIST OF FIGURES

Figure	Description
6.2A-5-1	ENVIRONMENTAL ORGANIZATION CHART

289 018

6.2A-3 ENVIRONMENTAL SURVEILLANCE

6.2A-3.1 Non-Radiological Surveillance

6.2A-3.1.1 Abiotic Surveillance

6.2A-3.1.1.1 Aquatic Surveys

6.2A-3.1.1.1.1 NPDES Permit-Related Surveys

Abiotic aspects of aquatic environments are surveyed in accordance with specifications set forth in the NPDES Permit.

9 6.2A-3.1.1.1.2 Erosion

Objective

The purpose of this specification is to insure that performance of the cooling
9 pond dike is not hampered by erosion or burrowing by animals.

Specifications

9 a. The cooling pond perimeter dike is inspected in accordance with Table 6.2A-3-1.

b. Deviations are permitted from this inspection schedule if data is unobtainable due to hazardous conditions, unavailability or malfunctioning of equipment. If the latter, every effort will be made to complete corrective action prior to the next sampling period.

c. This program is initiated at initial criticality of Unit 2.

289 019

Reporting Requirements

a. Results of these inspections are presented in the Annual Report according to Section 6.2A-5.6.1 of these Environmental Technical Specifications.

b. Deviations from the schedule outlined in Table 6.2A-3-1 are described in the Annual Report.

c. Unusual conditions which result in major repairs or actions other than normal housekeeping operations qualify for a 30-day report according to Section 6.2A-5.6.2(1) of these Environmental Technical Specifications.

Bases

9 The closed cycle operation of the Plant cooling system requires impoundment of the cooling pond with a dike to preclude many potential problems inherent to open cycle cooling. Annual inspection is adequate for confirming the readiness of this dike system. The survey described provides assurance that the cooling pond dike is maintained to perform the intended functions.

6.2A-3.1.1.2 Terrestrial Surveys

6.2A-3.1.1.2.1 Soil and Precipitation Chemistry

Due to the elimination of the blowdown cooling tower, monitoring of soil and precipitation chemistry is not necessary as there will be little or no chemical drift associated with the operation of the cooling pond.

289 020

TABLE 6.2A-3-1

9 OPERATIONAL EROSION SURVEILLANCE

Location	No of Samples	Parameters	Method	Frequency
Cooling Pond Perimeter Dike	1 Tour	Erosion, Burrowing	Visual	Annually

9

289 020

TABLE 6.2A-3-2

OPERATIONAL GROUNDWATER SURVEILLANCE

Location	No of Samples	Parameters	Frequency
2 Wells at Eight Locations on Cooling Pond Dike	19	Water Level	Monthly
		Pond Level	Monthly
		Specific Conductance	Annually
		Total Organic Carbon	Annually
		Calcium	Annually
		Sodium	Annually
		Magnesium	Annually
		Chloride	Annually
		Sulfate	Annually
		Bicarbonate	Annually
		Iron	Annually
		pH	Annually
Piezometers at Two Locations on Cooling Pond Dike	20	Level	Monthly

289 022

TABLE 6.2A-3-9

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM
OPERATIONAL PHASE

Exposure Pathway/ Sample Media	Collection Locations Number	Collection Locations Description	Sampling and Collection Procedure	Analyses	Bases
Airborne					
Radioiodine and Particulate	5	N, NE, E Sectors within 1000 m N Sector 2-3 mi S Sector 10-20 mi	Continuous sampling @ approximately 1 cfm with weekly collection. Sample size approximately 285 m^3.	Radioiodine cartridge: Weekly for I-131 Particulate filter: Gross beta weekly, gamma isotopic quarterly on composites by location.	7 To determine airborne radionuclide concentration at the predicted maximum location, highest population weighted location and ambient concentration outside of Plant influence.
7 Direct	9	N, NE, E, SE, WSW, NW Sectors @ Site Boundary N Sector 2-3 mi S, SW Sectors 10-20 mi	Continuous dose accumulation by two (or more) thermoluminescent dosimeters per location.	Gamma dose quarterly.	To determine direct radiation dose from atmospheric releases.
Waterborne					
Surface	2	Tittabawassee River upstream and downstream of the discharge	Composite sample over a one-month period.	Gamma isotopic analysis monthly, Tritium analysis quarterly.	To determine radionuclide concentrations resulting from Plant discharges.
7 Drinking	2	Midland and Bay City water supplies	Composite sample over a one-month period.	Gross beta and gamma isotopic monthly, Tritium analysis quarterly.	To determine dose contribution from water consumption.
Aquatic					
9 Sediment	2	Vicinity of intake and discharge	Semiannual collection on the discharge side of the river.	Gamma isotopic analysis semiannually	To detect if any buildup of discharged radioactive material is occurring in sediment.
Ingestion					
7 Food Products	3 1	NE Quadrant < 3 mi S Sector 10-20 mi	Collection of broadleaf vegetation monthly during the third quarter, as available.	Gamma isotopic and I-131 on edible portion only.	To determine if any accumulation of discharged radioactive material is occurring in edible vegetation.
Fish	2	Tittabawassee River upstream and downstream of discharge	Semiannual collection as available.	Gamma isotopic on edible portion only.	To determine if any concentration of discharged radioactive material is occurring in fish.

289 023

TABLE 6.2A-3-10

DETECTION CAPABILITIES FOR RADIOLOGICAL ENVIRONMENTAL SAMPLE ANALYSIS

LOWER LIMIT OF DETECTION (LLD)[a]

	Water (pCi/l)	Airborne (pCi/m^3)	Fish (pCi/kg, wet)	Food Products (pCi/kg, wet)	Sediment (pCi/kg, dry)
7 GROSS BETA	4	0.01	NA	NA	NA
^{3}H	1,000	NA	NA	NA	NA
^{54}Mn	15	NA	130	NA	NA
^{59}Fe	30	NA	260	NA	NA
^{58,60}Co	15	NA	130	NA	NA
^{65}Zn	30	NA	260	NA	NA
^{95}Zr-Nb	15	NA	NA	NA	NA
7 ^{131}I	1[b]	0.07	NA	60	NA
^{134,137}Cs	10,18	0.01	130	80	150
^{140}Ba-La	15	NA	NA	NA	NA

NA = Not Applicable

7 (a) LLD = The smallest concentration of radioactive material in a sample that will yield a net count (above system background) that will be detected with 95% probability (or a 5% probability of falsely concluding that a blank observation represents a "real" signal). It should be recognized that the LLD is defined as a priori (before the fact) limit representing the capability of the measurement system and not as a posteriori (after the fact) limit for a particular measurement.

(b) LLD for drinking water.

289 024

TABLE 12.1-1 1 of 13

LICENSES, PERMITS AND APPROVALS REQUIRED FOR THE PROTECTION OF THE ENVIRONMENT IN CONNECTION WITH THE CONSTRUCTION AND OPERATION OF THE MIDLAND PLANT UNITS 1&2

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
FEDERAL					
Atomic Energy Commission	Construction Permit - Unit 1 - Permit No CPPR-81 Unit 2 - Permit No CPPR-82	Land, Air and Water	Section 103, Atomic Energy Act of 1954, Title 10, Chapter 1, Part 50 of the Code of Federal Regulations	- -	Dec 15, 1972 Dec 15, 1972
Atomic Energy Commission	Amended Construction Permits - Unit 1 - Permit No CPPR-81 Unit 2 - Permit No CPPR-82	Land, Air and Water	Same as above	- -	May 23, 1973 May 23, 1973
8 Nuclear Regulatory Commission	Operating License	Land, Air and Water	Same as above (Submitted August 1977)	November 1980	-
9, 8 Nuclear Regulatory Commission	By-Product Material License	Land, Air and Water	Section 81, Atomic Energy Act of 1954, Part 30 of Title 10 of the Code of Federal Regulations (Application submitted May 17, 1979)	August 1979	-
9, 8 Nuclear Regulatory Commission	Special Nuclear Material License	Land, Air and Water	Section 161, Atomic Energy Act of 1954, Part 70 of Title 10 of the Code of Federal Regulations (Est application date late 1979)	August 1980	-

TABLE 12.1-1 2 of 13

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status	
				Est Issue	Actual Issue
Atomic Energy Commission	Review - Relocation of Bullock Creek	Land and Water	Request for Review from Directorate of Licensing, US Atomic Energy Commission, dated July 20, 1973	-	Aug 24, 1973
US Coast Guard	Permit - Construction of railroad bridge over Tittabawassee River Bridge Permit No 155-69	Land and Water	Title V, Section 502(b), General Bridge Act of 1946	-	Sept 9, 1969
US Coast Guard	Permit - Construct pipeway bridge over Tittabawassee River: Dow waste and process steam lines	Land, Air and Water	Title V, Section 502(b), General Bridge Act of 1946 (Dow Chemical Permit Application dated Jan 15, 1973)	-	Aug 7, 1973
US Army Corps of Engineers	Permit - Dredge and construct inlet and outlet structures Permit No 69-23-2	Land, Air and Water	Section 10 of the Rivers and Harbor Act of 1899 (33 USC 403)	-	Aug 5, 1969
8 US Army Corps of Engineers	Permit No 69-23-2 extension	Land, Air and Water	Section 10 of the Rivers and Harbor Act of 1899 (33 USC 403)	-	Jan 18, 1973 Dec 30, 1976
9 US Army Corps of Engineers 9	Permits - Transmission lines crossing over the Tittabawassee River	Land, Air and Water	Section 10 of the Rivers and Harbor Act of 1899 (33 USC 403). (Joint permit with MDNR. Est application date June 1979)	Sept 1979-Dec 1979	-

TABLE 12.1-1 3 of 13

	Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
9	US Army Corps of Engineers	Permits - Transmission lines structures adjacent to banks of the Tittabawassee and Bad Rivers and Beaver Creek	Land and Water	Section 404, Federal Water Pollution Control Act, as amended, PL92-500, 1972. (Joint permit with MDNR. Est application date June 1979)	Sept 1979-Dec 1979	-
8	US Army Corps of Engineers	Permit - Pond blowdown discharge structure on Tittabawassee River	Land and Water	Section 10 of the Rivers and Harbor Act of 1899 (33 USC 403) (Submitted [illegible]uary 1979)	July 1, 1979	-
	Federal Aviation Administration	Approval - Construction of two containment structures	Air	Part 77, Federal Aviation Regulations	Not Required - Buildings height less than 200 feet (Aug 7, 1973)	
9	Federal Aviation Administration	Approval - Construction of meteorological tower	Air	Part 77, Federal Aviation Regulations	-	July 26, 1974

289 027

289 028

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
STATE OF MICHIGAN					
Water Resources Commission	Order and Permit - To widen Tittabawassee River, relocate Waite and Debolt Drains, construct Bullock Creek Bridge, railroad bridge and cooling pond Order and Permit No FP-55	Land, Air and Water	Act 245, Public Acts of 1929, as amended by Act 167, PA 1968	-	June 25, 1969
Water Resources Commission	Order of Determination - Utilization of Tittabawassee River for cooling, condensing and process waste water Order No 1426	Water	Act 245, Public Acts of 1929, as amended by Act 167, PA 1968	-	Oct 15, 1970
Water Resources Commission	Order and Permit - Relocate Bullock Creek Drain Order and Permit No FP-314 (Amended Aug 8, 1973)	Land and Water	Act 245, Public Acts of 1929, as amended by Act 167, PA 1968	- -	March 22, 1973 Aug 8, 1973
Water Resources Commission	Permit - Discharge of treated waste water to the groundwaters of the State Permit No M00057	Land and Water	Act 245, Public Acts of 1929, as amended by Act 167, PA 1968	-	June 6, 1974
Water Resources Commission	Permit - For utilization of sanitary waste holding tanks	Land and Water	Act 245, PA 1929, as amended by Act 167, PA 1968	-	April 22, 1975
Water Resources Commission	Approval - Pollution Incident Prevention Plan	Land and Water	Rule 323.1162, Part 5 of the Water Resources Commission General Rules	-	Aug 30, 1974

289 029

TABLE 12.1-1 5 of 13

	Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
8 8	Water Resources Commission	Permit - National Pollution Discharge Elimination System: Original permit program by the US Army Corps of Engineers. Permit program now under the Environmental Protection Agency, Administered by the Water Resources Commission of the State of Michigan	Water	Section 402, Federal Water Pollution Control Act, PL92-500, 1972 (Submitted February 1978, Revised November 1978)	Mid 1979	-
	Water Resources Commission	Certification - Construction and operation of the Midland Plant will not violate water quality standards	Water	Section 21(b), Federal Water Pollution Control Act	-	March 12, 1971
	Same as above	Same as above	Water	Section 401, Federal Water Pollution Control Act, as amended PL92-500, 1972	-	Feb 28, 1973
	Water Resources Commission	Approval - Intake design contingent upon postoperational studies	Water	Section 316(b), Federal Water Pollution Control Act, PL92-500, 1972	-	Jan 17, 1977
8	Water Resources Commission	Permit - For utilization of septic tanks and disposal field systems	Land and Water	Act 245, PA 1929, as amended by Act 167, PA 1968	-	Dec 7, 1973

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
DNR-Bureau of Water Management	Permit - Dredge activity in Tittabawassee River Permit No 69-8-24	Water	Inland Lakes and Streams Act, Act 291, PA 1965	-	Aug 5, 1969 Dec 3, 1976
[8]	(Time Extension of Permit No 69-8-24) (Revised Permit No 69-8-24A)		Act 346, PA 1972	-	May 24, 1977
[9] DNR-Bureau of Water Management	Permits - Transmission lines crossing over Tittabawassee and Bad Rivers and Beaver Creek	Land, Air and Water	Inland Lakes and Streams Act 346, PA 1972 (Joint permit with COE. Est application date June 1979)	Sept 1979-Dec 1979	-
[9] DNR-Bureau of Water Management	Permits - Transmission lines structures on banks of the Tittabawassee and Bad Rivers and Beaver Creek	Land and Water	Soil Erosion and Sedimentation Control Act 347, PA 1970 (Joint permit with COE. Est submittal date June 1979)	Sept 1979-Dec 1979	-
DNR-Bureau of Water Management	Permit - Dredge and relocate Bullock Creek Drain Permit No 73-CPC-2	Land and Water	Inland Lakes and Streams Act 346, PA 1972	-	June 13, 1973
[8]	Permission - Relocated Channel to Remain				June 27, 1975
DNR-Bureau of Water Management	Permit - Dredge and place brine pipelines under Bullock Creek Permit No 74-8-9	Land and Water	Inland Lakes and Streams Act, Act 346, PA 1972	-	March 20, 1974
DNR-Bureau of Water Management	Permit - Channel relocation of Bullock Creek - bridge construction. Permit No 74-8-45	Land and Water	Inland Lakes and Streams Act, Act 346, PA 1972	-	June 19, 1974

TABLE 12.1-1 7 of 13

	Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
8	DNR-Water Management Division	Permit - Place fill for emergency exit ramp, Permit No FP-1085	Land and Water	Act 245, PA 1929	-	Oct 3, 1978
	DNR-Bureau of Water Management	Permit - Construct a boat ramp, Permit No 77-8-146	Land and Water	Inland Lakes and Streams Act, Act 346, PA 1972	-	Aug 23, 1977
9 8	DNR-Bureau of Water Management	Permit - Pond blowdown discharge structure on Tittabawassee River	Land and Water	Inland Lakes and Streams Act, Act 346, PA 1972 (Submitted January 1979)	July 1, 1979	-
9 8	DNR-Bureau of Water Management	Permit - Steam and condensate lines across Bullock Creek	Land and Water	Inland Lakes and Streams t, Act 346, PA 1972 (Submitted April 1979)	July 1, 1979	-
9	DNR-Water Management Division	Perr - Combine Spill Prevention, Con' ol & Countermeasure/Pollution Inc ent Prevention (SPCC/PIP) Plan	Water	Act 245, PA 1929	Aug 31, 1979	-
	DNR-Office of Planning Services	Review - Historical/Archaeological considerations by the State Historic Preservation Coordinator	Land	US Dept of the Interior Request-Review of AEC Draft detailed statement on Environmental Consideration	- -	June 24, 1971 May 4, 1972
	DNR-Geological Survey Division	Permit - Foundation borings Permit No 457-732-156	Land and Water	Mineral Wells Act, Act 315, PA 1969	-	July 9, 1973
8	DNR-Geological Survey Division	Permit - Foundation borings, Permit No 753-782-156	Land and Water	Mineral Wells Act, Act 315, PA 1969	-	May 1, 1978

TABLE 12.1-1 8 of 13

	Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status Est Issue	Status Actual Issue
9	DNR-Geological Survey Division	Permit - Foundation borings, Permit No 180-729-156	Land and Water	Mineral Wells Act, Act 315, PA 1969	-	Feb 12, 1979
8	DNR-Geological Survey Division	Permit Groundwater Monitoring Wells, Permit No 606-792-456	Land and Water	Mineral Wells Act, Act 315, PA 1969	-	April 3, 1979
	DNR-Hydrological Survey Division	Permit Amendment - Construction of temporary culvert in Bullock Creek and construction of haul road	Land and Water	Inland Lakes and Streams Act, Act 291, PA 1965	-	July 24, 1973
8						
8	DNR-District Fire Supervisor	Permit - Open fire burning (Last annual burn permit issued 1/18/77, expired 12/31/77. Permit not renewed)	Air	Act 329, PA 1969	- -	Nov 20, 1973 May 21, 1974 Jan 1, 1975 Jan 18, 1977
	DNR-Bureau of Environmental Protection	Permission - To discharge ponded storm water into the Tittabawasee River	Water	Permit Not Required	-	April 8, 1976
9	Air Pollution Control Commission	Permit to install fuel burning equipment (auxiliary boiler)	Air	MAPCC Rule 336.21	-	May 25, 1979

TABLE 12.1-1 9 of 13

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
8 Air Pollution Control Commission 9	Permit to install fuel burning equipment (emergency diesel generators)	Air	MAPCC Rule 336.21 (Application submitted M?? 21, 1979)	July 1979	-
Public Service Commission	Order - Authorization to construct railroad spur across south Saginaw Road, Order #RR-5166	Land	Act 336, PA 1931	-	July 20, 1970
9 Public 8 Service 9 Commission	Permits - To construct transmission lines in Midland Plant project area	Land	MPSC No 1868 of 1954 (Est application date June 1979)	Sept 1979-Dec 1979	-
Michigan 8 Department of 9 Transportation	Permits - Cross CP Co railroad tracks with transmission lines	Land	MPSC No 1868 of 1954 (Est application date June 1979)	Sept 1979-Dec 1979	-
8 COUNTY, TOWNSHIP, AND CITY					
Probate Ccurt for County of Midland	Order of Necessity - Condemnation of lands for transmitting, distributing, selling and supplying electrical energy No 20402	Land, Air and Water	Act 236, PA 1961	-	Feb 17, 1970
Midland Co Board of Supervisors	Approval - Construct railroad bridge over Tittabawassee River	Lan' and Wa:er	Mich Const of 1963 Act 7 12, MCLA 46, 21	-	Aug 21, 1969

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
3 Midland Co Road Commission	Approval - Construction of temporary road for River Road - Plant outfall structure area	Land and Water	Act 283, PA 1909	-	Aug 27, 1969
Midland Co Road Commission	Approval - Resolution to vacate portions of Miller, Stewart, River and Sasse Roads	Land and Water	Section 18, Chapter 4, Act 283, PA 1909	-	March 25, 1971
Midland Co Road Commission	Permit - Construction of access road between Miller and Poseyville Roads Permit No 111473E	Land and Water	MCLA 224.1 et seq	-	Nov 15, 1973
Midland Co Road 3 Commission	Approval - By resolution abandonment and discontinuance of portions of Sasse Road	Land and Water	Section 18, Chapter 4, Act 283, PA 1909	-	April 11, 1974
Midland Co Road Commission	Permit - Crossing under Gordonville Road with brine pipelines Permit No 7104A	Land and Water	MCLA 224.1 et seq	-	July 11, 1974
8 Midland Co Road Commission	Verbal approval to widen access road (CP Co Letter No 2335, dated June 8, 1977)	Land and Water	Permit Not Required	-	June 8, 1977
3 Midland Co Drain Commission	Approval - Relocation of Waite and Debolt County Drain and relocation of Bullock Creek Drain	Land and Water	MCLA 280.2 MCLA 280.10	-	Jan 20, 1969 March 8, 1973

289 035

TABLE 12.1-1 11 of 13

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
Midland Co Drain Commission	Approval - Crossing under Waite and Debolt Branch #1 Drain, Waite and Debolt Drain and Bullock Creek Drain with brine pipelines	Land and Water	MCLA 280.2 MCLA 280.10	-	April 11, 1974
Midland Co Drain Commission	Approval - Channel improvement and construction of service road bridge over Bullock Creek	Land and Water	MCLA 280.2 MCLA 280.10	-	April 18, 1974
8 Midland Co Drain Commission	Final Order of Abandonment - Bullock Creek outlet portion Midland County Farm Drain, Waite and Debolt and Branch One Drain, Bailey School and Branch Drain	Land and Water	Act 40, PA 1956	-	May 16, 1978
3 Health Department (Midland City-County)	Permit - Construction of temporary septic systems (two)	Land, Water and Air	Midland County Board of Health Rules and Regulations, May 1, 1970	-	Nov 12, 1973 Nov 16, 1973
8 Midland Co Engineer	Permit - Emergency exit ramp, Permit No 78-30	Land and Water	Act 347, PA 1972	-	Aug 30, 1978
1 Midland Township Board	Order and Permit - To widen channel of the Tittabawassee River	Land and Water	Act 184, PA 1943	-	July 11, 1969
8 Midland Township 8 Zoning Board of Appeals	Findings and Order - To construct and operate Midland Plant and pond	Land, Water and Air	Midland Township Zoning Ordinance, Article 13, Section 1[illegible]2	-	March 18, 1970 (modified July 7, 1977)

289 036

TABLE 12.1-1 12 of 13

	Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
8	Midland Township Zoning Board of Appeals	Findings and Order - To construct and operate cooling ponds and structures on former Mergard Property	Land, Air and Water	Midland Township Zoning Ordinance, Article 13, Section 13.2	-	May 30, 1974
8	Midland Township Zoning Board of Appeals	Findings and Order - To construct and operate electrical transmission substation, and railroad line	Land, Water and Air	Midland Township Zoning Ordinance, Article 13, Section 13.2	-	March 24, 1971
	Ingersoll Township Zoning Board	Permit - Construction of Meteorological Tower Building Permit No 650	Land and Air	Section 15.1.2.1 of the Ingersoll Township Zoning Ordinance #2	-	Nov 11, 1974
3						
8	Tri-City Area Joint Airport Zoning Board	Permit - Construction of reactor and auxiliary buildings, Permit No 14	Land, Air and Water	Act 23, PA 1950 Tri-City Joint Airport Zoning Ordinance, effective 6/11/70	-	Sept 4, 1973
9	Tri-City Area Joint Airport Zoning Board	Approvals - Transmission facilities in the Midland Plant project area	Land and Air	Act 23, PA 1950, Tri-City Joint Airport Zoning Ordinance, effective 6/11/70 (Est submittal date July 1979)	Sept 1979-Dec 1979	-
8	Tri-City Joint Airport Zoning Board	Building Permit No 22 and certificate of variance 300-foot Meteorological Tower	Land and Air	Act 23, PA 1950, Tri-City Joint Airport Zoning Ordinance, Effective 6/11/70	-	Oct 22, 1974

TABLE 12.1-1 13 of 13

Agency	Authorization Required (License, Permit or Approval)	Primary Impact	Statute or Authority	Status: Est Issue	Status: Actual Issue
Midland City Council	Permission - Construction of railroad crossing on South Saginaw Road	Land and Water	Act 279, PA 1909 Chapter 22, Code of Ordinance, City of Midland	-	July 28, 1969
Midland City Council	Permission - Rebuild portions of South Saginaw Road to accommodate railroad crossing	Land and Water	Act 279, PA 1909 Chapter 20, Code of Ordinance, City of Midland	-	July 28, 1969
Midland City Engineer	Approval - Construction of pipeway bridge over Tittabawassee River	Land and Water	Ordinance of the Township of Midland (Dow Chemical Request)	-	Dec 11, 1972
8 City of Midland	Permit - Soil erosion and sedimentation control, Permit No 15031	Land and Water	Act 347, PA 1972	-	July 14, 1977
City of Midland	Permit - Soil erosion and sedimentation control, Permit No 15033	Land and Water	Act 347, PA 1972	-	Aug 3, 1977
City of Midland	Permit - Soil erosion and sedimentation control, pond blowdown discharge structure, Permit No 5054	Land and Water	Act 347, PA 1972	-	March 23, 1979
9 City of Midland	Permit - Soil erosion and sedimentation control, steam and condensate lines across Bullock Creek, Permit No 5060	Land and Water	Act 347, PA 1972	-	May 25, 1979

3 NOTE: Annual building, electrical, plumbing, and mechanical permits received from both the City of Midland and Midland Township are not listed in this Table.

Chapter 3

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9 Plant - Cooling Pond Operation Study (March 1979), Report prepared for Consumers Power Company.

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289 039

Chapter 5

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9 Alden Research Laboratories, Investigation of a Thermal Plume in a Shallow River - Hydrothermal Model Studies - Cooling Pond Blowdown Discharge - Midland Nuclear Power Station (April 1979), Research sponsored by Bechtel Power Corporation for Consumers Power Company.

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9 Bechtel Associates Professional Corporation, Final Report - Midland Power Plant - Cooling Pond Operation Study (March 1979), Report prepared for Consumers Power Company.

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041

289 [illegible]

NRC QUESTIONS AND RESPONSES

TABLE OF CONTENTS

042

289

Question ID	NRC Request	ER Revision	Page No
10a	May 22, 1978	2, 3	B-C 10a-1
11	May 22, 1978	2	B-C 11-1
12	May 22, 1978	2	B-C 12-1
13	May 22, 1978	2, 3	B-C 13-1
14a	May 22, 1978	2	B-C 14a-1
14b	May 22, 1978	2	B-C 14b-1
15	October 18, 1978	3, 4, 7	B-C 15-1
Endangered Species			
1	October 11, 1978	3, 4	END 1-1
2	October 11, 1978	3, 4	END 2-1
3	October 11, 1978	3, 4	END 3-1
4	October 11, 1978	3, 4	END 4-1
5	December 22, 1978	5	END 5-1
6	December 22, 1978	5	END 6-1
Floodplain Management			
1	January 31, 1979	6, 7	FPM 1-1
2	January 31, 1979	6, 7	FPM 2-1
3	January 31, 1979	6, 7	FPM 3-1
Heat Dissipation			
1	May 22, 1978	2	HDS 1-1
2	May 22, 1978	2	HDS 2-1
3	May 22, 1978	2	HDS 3-1
4	May 22, 1978	2	HDS 4-1
Hydrology, Water Use and Water Quality			
1	May 22, 1978	2	HYD 1-1
2	May 22, 1978	2	HYD 2-1
3	May 22, 1978	2	HYD 3-1
4	October 11, 1978	3	HYD 4-1
5	October 11, 1978	3, 9	HYD 5-1
6	October 11, 1978	3, 9	HYD 6-1
7	October 11, 1978	3	HYD 7-1
8	October 11, 1978	3, 4	HYD 8-1
9	October 11, 1978	3, 4, 5	HYD 9-1
10	October 11, 1978	3, 4	HYD 10-1
11	October 11, 1978	3	HYD 11-1
12	October 11, 1978	3	HYD 12-1
13	October 11, 1978	3, 4	HYD 13-1
14	October 11, 1978	3	HYD 14-1
Meteorology			
1	May 22, 1978	2	MET 1-1
2	May 22, 1978	2	MET 2-1
3	May 22, 1978	2	MET 3-1
4	May 22, 1978	2, 3	MET 4-1
5	May 22, 1978	2	MET 5-1

289 044

AQUATIC ECOLOGY

QUESTION 2

What are conservative levels of metal concentrations from the plant discharge and what is the anticipated size of the chemical plume to produce a 1:9 dilution at various flows (from anticipated lowest flows to average flow)?

RESPONSE

2

Corrosion products are addressed in Section 3.6.4.3. Assuming that the corrosion product quantities described in this Section are present in the cooling pond blowdown at the average blowdown rate, this would result in metal concentration incremental increases as follows:

Copper	0.2 ppm
Zinc	0.07 ppm
Tin	0.002 ppm
9 Iron	0.3 ppm

However, it is expected that most of these corrosion products will be assimilated in cooling pond sediment.

The estimated size of the chemical plume to produce a 1:9 dilution over a range of river flow is as follows:

River Flow After Makeup Withdrawal (cfs)	Length Along Bank (ft)	Area Enclosed (Acres)
770	5,000	7
3,450	14,000	25

These estimations are based on isotherms observed in the physical model at the
9 Alden Research Laboratory. Because the effluent from the tertiary pond of Dow
Chemical Company was included in the model with an excess temperature of 5°F,
the estimated size should be conservative.

AQUATIC ECOLOGY

QUESTION 10

Please explain plant operations in regards to water intake, discharge and use of cooling pond water during a 100-day drought (ER, pp. 3.4-5 and 3.4-6). Will river water be able to be used for make-up water? Will normal discharges be made to the Tittabawassee River? If cooling pond water has to be used during 100-day droughts to maintain normal station operations, thus depleting cooling pond volume with time, to what degree will the 5°F discharge plume enlarge over time (e.g., when the cooling pond is 3/4, 1.2, and 1.4 full)? Provide estimate of chemical releases to the Tittabawassee River under these three cooling pond conditions.

RESPONSE

ER Section 3.4.3 has been revised to clarify cooling pond operation, makeup system operation, and blowdown system operation during a 100-day drought.

2 ER Section 3.4.5 has been expanded to include a statement that blowdown will be maintained within the thermal limits discussed in ER Section 5.1.

ER Section 3.6 has been revised to clarify that normal chemical discharges
excluding pond blowdown are made during the 100-day drought. However, the
9 high TDS discharges can be routed to the cooling pond if river TDS conditions
do not permit their discharge to the river.

The discharge of chemicals to the Tittabawassee River is presented in ER
2 Section 3.6. Both maximum and average values for blowdown are provided. As

2 intermediate pond condition values at intermediate pond capacities are within the maximum pond concentration listed in Section 3.6, these intermediate values are not included.

AQUATIC ECOLOGY

QUESTION 12

Provide a draft copy of the cooling pond discharge performance study done by ALDEN.

RESPONSE

Six copies of each of the following two final reports were provided to the Nuclear Regulatory Commission under separate cover on May 21, 1979:

a. Investigation of a Thermal Plume in a Shallow River - Hydrothermal
9 Model Studies - Cooling Pond Blowdown Discharge - Midland Nuclear Power Station, Alden Research Laboratory, April 1979.

b. Midland Power Plant - Cooling Pond Operation Study, Bechtel Associates Professional Corporation, March 1979.

3

HYDROLOGY, WATER USE AND WATER QUALITY

QUESTION 5

The Midland plant has a well-defined schedule for obtaining makeup water from the Tittabawassee River to the cooling pond; however, a discharge scheme to the river is undefined. Identify the planned discharge scheme. Incorporate in your response: circumstances under which discharge will occur during low flow, whether discharge will occur when makeup is not occurring, and whether makeup and discharge volumes will be constant during the entire year.

RESPONSE

9 Refer to revised ER Sections 3.4.5 and 5.1.2 which describe the planned
cooling pond blowdown discharge scheme. Makeup and blowdown volumes are not
3 constant during an entire year. During the months of March, April, and May,
pond blowdown discharge will most likely be continuous. For the remaining
months, the pond blowdown discharge may be intermittent. At any given
9 instant, the pond blowdown flows may be between 5 and 220 cfs or there may be
no pond blowdown discharge flow. Normally, pond makeup occurs as necessary
when river flow is adequate (refer to ER Section 3.4.4) to offset evaporation
3 and pond blowdown losses and makeup can occur without pond blowdown. At any
instant, when the pond is full, pond blowdown can occur without pond makeup in
9 accordance with the operating scheme presented in revised ER Sections 3.4.5
and 5.1.2.

HYDROLOGY, WATER USE AND WATER QUALITY

QUESTION 6

At the site visit (September 6, 1978), it was learned that a new model has predicted a different thermal plume. Indicate the expected size of the mixing zone during worst case conditions using the new model.

RESPONSE

Only one physical model is used to predict thermal plumes in the Tittabawassee
River. During earlier stages of the physical model test program conducted at
Alden Research Laboratory, relatively large blowdown flowrates for given river
discharges were used which resulted in long thermal plumes. As the model
study progressed, an analytical simulation of the cooling pond operation
employing preliminary physical model test results was made. The simulation
3 indicated that smaller blowdown flowrates are sufficient to control pond total
dissolved solid concentration within satisfactory levels. In the final
physical model test series, the edge of thermal plumes as defined by location
of the 5°F isotherm as determined by the average temperatures obtained by 25
scans of each thermocouple are forced to terminate within the physical model
by reducing blowdown flowrates. Maximum allowable blowdown flowrates were
determined in the laboratory over a range of blowdown excess temperatures for
five river discharges covering the range from 920 to 3650 cfs. The
9 anticipated operational cooling pond blowdown discharge scheme and physical
effects are described in ER Section 5.1.2.

289 050

PLANT EFFLUENT CHEMISTRY

QUESTION 1

Please explain why the average values of intake, evaporation, and blowdown water flows differ markedly in Section 2.4.5.1, p. 2.4-10 and in Table 3.3-2.

RESPONSE

9

The numbers appearing in ER Section 2.4.5.1 and in Table 3.3-2 have been adjusted to reflect the final cooling pond operation study results.

PLANT EFFLUENT CHEMISTRY

QUESTION 4

Please explain why the value of the incremental increase in sulfate concentration given in Table 3.6-4 is not consistent with the sulfuric acid use given in Table 3.6-6. What is the basis of the acid use calculation and what parameters were used for water quality?

RESPONSE

It is anticipated, but cannot be quantified, that the long exposure in the cooling pond (3-6 days) to atmosphere, and cooling pond sediment, rip-rap, and
2 suspended matter will adversely affect the parameters used to determine the Langelier Index. Hence, the value for annual sulfuric acid use given in ER Table 3.6-6 for the circulating water system represents the maximum rating of the acid injection system.

The average and maximum values given in ER Table 3.6-3 were used to compute
9 the 200 ppm average and 1100 ppm maximum increases in pond sulfate concentration given in the footnote (a) of ER Table 3.6-4. This estimate
2 assumed that the cooling pond has no effect on the parameters used to determine the Langelier Index.

289 053

PLANT EFFLUENT CHEMISTRY

QUESTION 6

How were the values for the maximum chemical concentrations determined? (ER, Table 3.6-4)

RESPONSE

9 The maximum expected chemical concentrations were based on the maximum TDS
concentration determined by the cooling pond operation study.

2 Tittabawassee River water analyses gathered by the Applicant's water quality
monitoring program were examined for maximum ratios of parameter concentration
9 to TDS concentration. These maximum ratios were then applied to the maximum
TDS concentration to estimate the maximum expected parameter concentration for
the cooling pond blowdown.

2 The maximum expected chemical concentrations in the combined Plant discharge
were estimated by combining the maximum expected cooling pond blowdown plus
9 footnote (a) values at the minimum blowdown flow with the maximum expected
2 chemical concentrations and flows given in Table 3.6-2.

289 054